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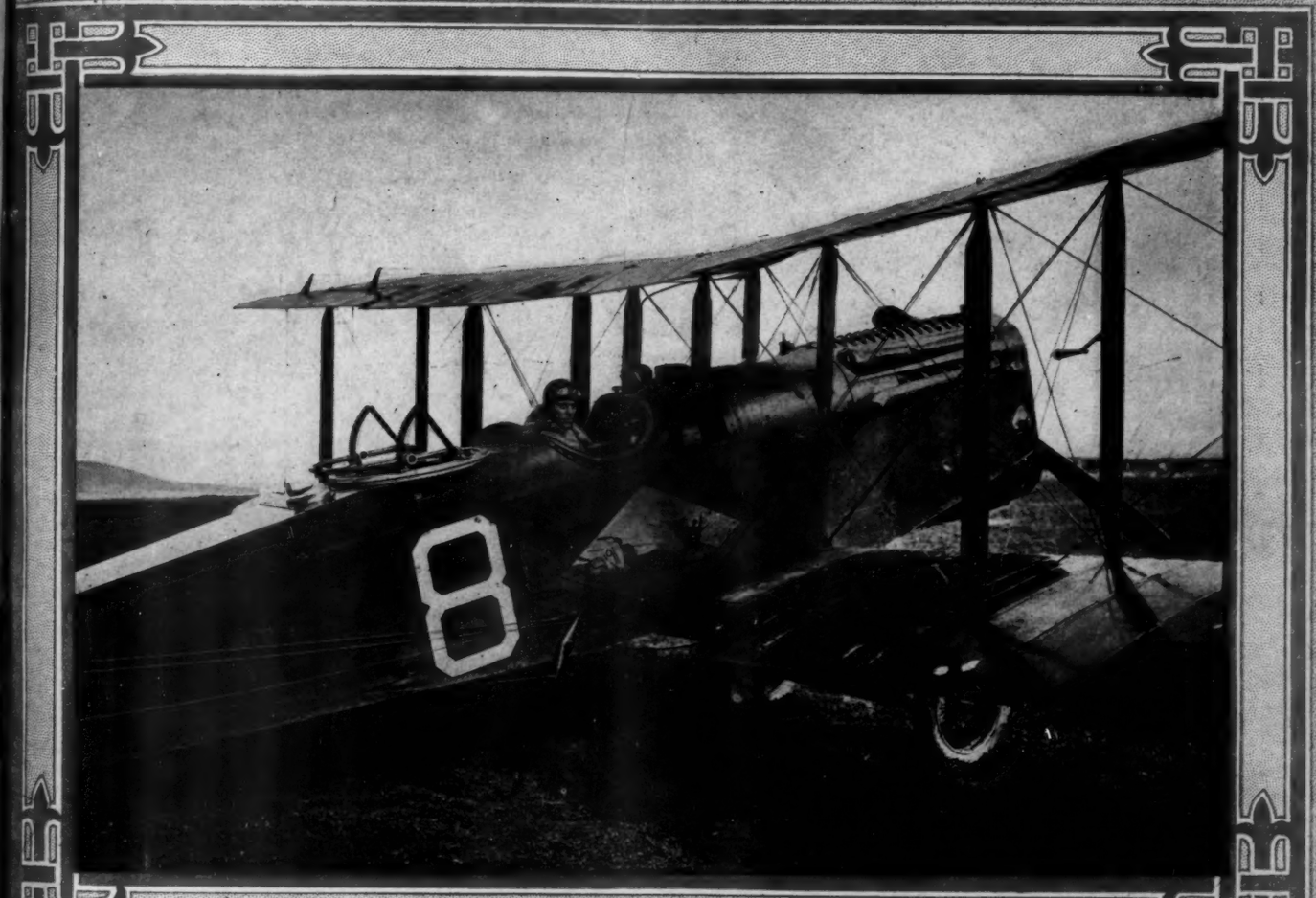

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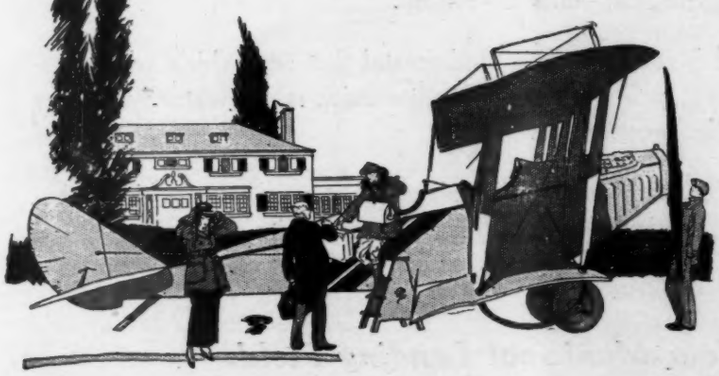

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MARCH 14, 1921 VOL. X. NO. 11

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AVIATION
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Vol. X | MARCH 14, 1921 | No. 11

President Harding

ON the eve of his inauguration President Harding made an announceemnt to the press which is of the greatest importance to aviation in this country. He is reported as favoring the creation of a Department of Defense, headed by one Cabinet officer, which would have three divisions of virtually equal rank, the army, the navy and the air force. Each would be in charge of an under-secretary.

This news, while hidden in an obscure newspaper report, is cheering to all those who believe that the present method of handling governmental air activities is unworkable.

The British Ministry of defense has followed this plan but some of the practical workings of it have passed through the experience of all new experiments. Fundamentally, the idea is sound. Rivalry, jealousy and competition have no place in any scheme for national defense. By placing the air force on an equal plane with the army and navy, President Harding will be starting right and it is to be hoped that this consolidation will prove one of the great achievements of the Harding Administration.

Fast Transcontinental Flights

THE two recent transcontinental flights made by the Air Mail Service and the Army Air Service, respectively, furnish striking instances of the possibilities aircraft will offer once their use is fully developed. In the one instance, United States mails were carried by means of a perfectly functioning relay system and the application of night flying over a distance of 2,650 miles in 33 hr. 20 min. of elapsed time. In the other case an Army aviator crossed the United States from Southern California to Florida with a single stop enroute, covering a distance of 2,100 miles in 22½ hr. flying time. That he lost about 14 hr. at the intermediate stopping point does not in the least reduce the value of the performance; lack of suitable fuel alone was responsible for it.

The services which were responsible for these great performances are to be warmly congratulated. Men and machines alike stood the trying tests extremely well. Extended night flying by compass navigation was proved to have emerged from the experimental stage. Mail pilot Knight followed a course by night he had never flown in day time and arrived at his destination without much difficulty. What enhances his feat is that he made an intermediate landing, on schedule, on a field illuminated by flood lights, from which he again took off without much ado. The lengthy experiments of Air Mail pilots with landing and taking off by night have evidently borne fruit.

Lieutenant Coney, on the other hand, duplicated his first night flight—which was scheduled—by covering the second lap of his flight by night also, which was not foreseen in his schedule.

Thus, three remarkable demonstrations of night flying under conditions of service tests and under different circumstances were furnished by Air Mail and Army pilots. They emphasize with particular force the ever growing potentiality of aircraft for war and peace, and the stupendous shrinking in distances their advent portends.

Tank and Repair Airplanes

THE trans-American flight of Lieut. William D. Coney suggests the desirability of a new development by the Air Service. This is the construction of special tank airplanes, similar in purpose to the fleet tankers of the Navy.

It is rather absurd for an airplane to cover a thousand miles in seven or eight hours and then be forced to lose valuable time, sometimes days, sitting in a pasture because high grade gasoline and oil lacks equally rapid means of transit. The development of tank airplanes, safeguarded by special fire protection, therefore seems a logical step forward in the progress of aviation. Their use should prove of benefit to the Army Air Service, for it will tend to reduce the number of aircraft immobilized in out-of-the way places owing to lack of fuel.

Another type of airplane that might be worth while developing, is the repair machine. This would carry a certain number of "first-aid" spares, such as wheels, axles, shock absorbers, propellers, piston rings, valve springs, etc. Its appearance would certainly be welcomed by pilots forced to make a landing for a minor engine defect which is not adjustable with the means carried on board. It would be similarly valuable in cases where an emergency landing deleted the undercarriage or where the machine nosed over, breaking the propeller.

Japanese Aircraft Progress

THAT Japan has been developing aviation for her Army and Navy is well known. The tendency to follow British practice in regard to naval aviation and French methods for airplanes is reported. The Evening Standard of London has printed the following news which should be of interest to our government:—

"Energetic interest is being displayed by the Japanese in the development of commercial aviation. Substantial orders, it is understood, have been placed in this country for British aeroplane engines and parts and for flying boats of British construction.

"Manufacturers of aeroplanes and their accessories are going out for the purpose of opening up business with the Japanese, whose ultimate object is to establish land and coast routes for commercial purposes in various parts of the Eastern Empire."

As it is generally conceded that the recruiting reservoir for the air force of any country will eventually come from its commercial pilots and that the country having the strongest commercial air development will be the best prepared in an emergency, too much information cannot be secured regarding the air transport activities of other countries.

Battleships to Be Bombed

Bombing experiments with the radio-controlled battleship Iowa and with the ex-German warships, allocated to the United States, as targets will be conducted by Army and Navy forces jointly, according to an announceemnt made by Secretary Daniels. In addition he announced that one of the later type of the obsolete battleships, probably the Kentucky, will be turned over to the Army fliers for experiments to develop tactics off-shore aerial attacks on warships by land planes.

Several months ago the Navy Department, under instructions from the Secretary, began working out plans for exten-

CAPT. T. T. CRAVEN, U. S. N., DIRECTOR OF NAVAL AVIATION 1919 TO MARCH 1, 1921

sive experiments to determine the effectiveness of aircraft against surface craft. The first of these experiments was conducted with the Indiana as a target.

On. Feb. 7, Secretary Daniels wrote the Joint Army and Navy Board suggesting that the other experiments that were to be carried on, should be made jointly by the Army and Navy and asking the board to investigate and make recommendations.

The following recommendations were submitted as a consequence on March 1 by the Joint Board to the Secretary of the Navy and approved by him:

"After careful consideration and study of the bombing experiments already directed by the Navy Department, and consultation with the Acting Chief of the Army Air Service and the Director of Naval Aviation, The Joint Board has reached the following conclusions:

(*a*) That the bombing experiments contained in the exercises to be conducted by the Navy are designed to determine:

1. The ability of aircraft to locate vessels operating in the coastal zone and to concentrate on such vessels sufficient bombing airplanes to make an effective attack.

2. The probability of hitting with bombs from airplanes, a vessel under way and capable of maneuvering, but incapable of anti-aircraft defense.

3. The damage to vessels of comparative recent design which will result from hits with bombs of various types and weights. The vessels to be attacked by bombing are of the battleship, light cruiser, destroyer and submarine types.

(b) That these experiments carried out at sea in deep water will demonstrate the effect of an airplane bombardment of naval craft more effectively than experiments conducted with the vessels at anchor in shallow water.

(c) That the experiments outlined by the Navy Department do not contemplate experiments in the use of machine guns against personnel in exposed positions nor the effect of gas, incendiary, and smoke bombs.

(d) That the tactics to be used in attacking naval vessels by aircraft are not well developed.

2. The Joint Board therefore recommends:

(a) That, the Navy Department invite the War Department to authorize the Army Air Service to participate in the search, concentration and bombing experiments to be carried out by units of the Naval Air Service under direction of the Commander-in-Chief, U. S. Atlantic Fleet as directed by letters (attached) of the Secretary of the Navy, with the understanding that nothing contained in these instructions shall be construed to prevent the Army Air units from making at least two hits with the largest type of bombs that may be available.

(b) That, referring to reference (b) (letter of Secretary of Navy to Commander-in-Chief, U. S. Atlantic Fleet on subject—Destruction of Enemy Shipping in Custody of U. S. Navy, the Navy Department turn over to the War Department an obsolete battleship fitted with at least one cage mast, to be utilized for the purpose of developing the tactics of aircraft in attacking naval vessels, experimenting with gas, incendiary and smoke bombs, and for the development of any type of bombs to be used against naval vessels. The rules and conditions for these experiments to be prescribed by the War Department, but no report of conclusions as to the probable damage to personnel or equipment or probably or actual damage to the water-tight integrity of the target vessel or vessels in general shall be made except by a board in which the Navy shall have representation. In case such a report is required by the War Department, the Navy Department to be requested to designate and order naval officers as its representatives on the Board. The War Department to invite the Navy Department to authorize the Naval Air Service to participate in these experiments.

(c) That the results of these experiments and the conclusions drawn therefrom be held secret by the War and Navy Departments until passed upon by the Joint Board, and that all officers concerned in making these experiments be instructed accordingly.

Full Plan of Operations

The full plans for the experiments to be conducted by the Army and Navy fliers using the former German warships as targets, and the plans for the experiments with the radio-controlled Iowa to determine the present value of aircraft operating from shore bases against naval vessels, unattended by aircraft follow:

In order to determine the maximum effectiveness of aircraft of heavier-than-air type in the present state of development when conducting operations against surface vessels unattended by aircraft, the experiments outlined below will be carried out under the direction of the Commander-in-Chief, Atlantic Fleet by all available units of the Air Force, and other units of the Atlantic Fleet, and such other air units or unassigned vessels as may be designated by the Department. The experiments shall be commenced as soon as practicable after June 1, 1921, and shall be completed before July 15, 1921.

In preparing this order, the Department has been guided by the following considerations:

(a) Successful naval warfare insures freedom of movement of our own merchant vessels and transports, and denies freedom of movement to enemy vessels. The continuation of trade during war is, for most nations, a necessity. A blockade against the foreign commerce of a nation may, unless the enemy has a strong naval force, be made effective without a close approach to the enemy coast.

(b) Modern fleets will be accompanied by aircraft and vessels will be armed with anti-aircraft batteries.

(c) Landing operations by armies on the coast of a first class power are, in these days of large armies, rapid transportation, and effective mobile coast defense, practically impossible, until the control of the sea is gained and the morale and military strength of the enemy nation seriously reduced by blockade, or other activities.

(d) Raiding operations in the coastal waters of an enemy nation will be required to suppress coastwise traffic. This type of operation will usually be conducted by submarines, destroyers, minelayers, or fast cruisers.

(e) It is in defense against operations of this last type by naval vessels that shore based aviation will be the most effectively employed. The experiments should therefore be made to simulate attacks by aircraft on vessels conducting operations of this nature.

(f) Operations against naval units operating in the coastal zone, from the point of view of the effectiveness of aircraft, divide logically into three phases.

(a) The location of such naval units.

(b) The ability of the aircraft to hit vessels with their projectiles.

(c) The ability of the projectiles to seriously damage a vessel.

3. In view of the above the experiments shall be conducted in three phases:—

(a) The location by aircraft of naval vessels operating in a zone off the coast, and after the location of such vessels the concentration of sufficient aircraft for effective bombing operations against such vessels.

(b) Actual bombing tests from the aircraft so concentrated, using dummy bombs of standard size, form and weight against the U. S. S. Iowa, steaming at her highest practicable speed and maneuvering under radio control. These tests are for the purpose of determining the accuracy with which bombs can be dropped over the sea.

(c) Actual tests with live bombs from aircraft against ex-German war vessels which are to be destroyed. These tests shall be carried out in accordance with instructions contained in letter of Secretary of the Navy of February, 1921.

4. The Department desires that the tests set forth in paragraph 3 (a) and (b) above be carried out in general along the following lines, and the Commander-in-Chief to arrange all details:—

The exercise will simulate a search prolem and a surprise attack by a squadron or squadrons of bombing planes on a division of cruisers.

The exercise will be carried out with such aircraft and personnel as the Commander-in-Chief can assemble from the Atlantic Fleet Air Force and the other detachments assigned to his command for this purpose.

The exercise will be held in the open sea during daylight in good weather. The target will consist of coast battleship No. 4, ex-U.S.S. Iowa, under radio control.

The method of attack to produce maximum number of hits will be determined by the Commander-in-Chief, but will simulate actual service conditions as nearly as possible. The minimum altitude will be 4,000 ft. The speed of aircraft throughout the attack will be the maximum attainable.

All aircraft will be fully equipped for service conditions, including radio equipment, machineguns and ammunition, and the personnel to operate them. Dummy bombs will be assigned by the Bureau of Ordnance for each type of plane. The total number of bombs dropped will depend on the carrying capacity of the aircraft and the number of aircraft available.

The Senior Officer present will fix the standard time at which the exercise will begin. This time will be the zero hour.

At the zero hour the coast battleship No. 4 will be at a point within a zone between 50 and 100 miles off the Coast between Cape Hatteras and Cape Henlopen, and from that time until the attack is delivered will steam at a maximum practicable speed and on any course in the general direction of the shore. Doctrine to avoid bombs should govern its maneuvers as nearly as possible, after planes are sighted. The position of the Iowa will be unknown to the bombing squadron.

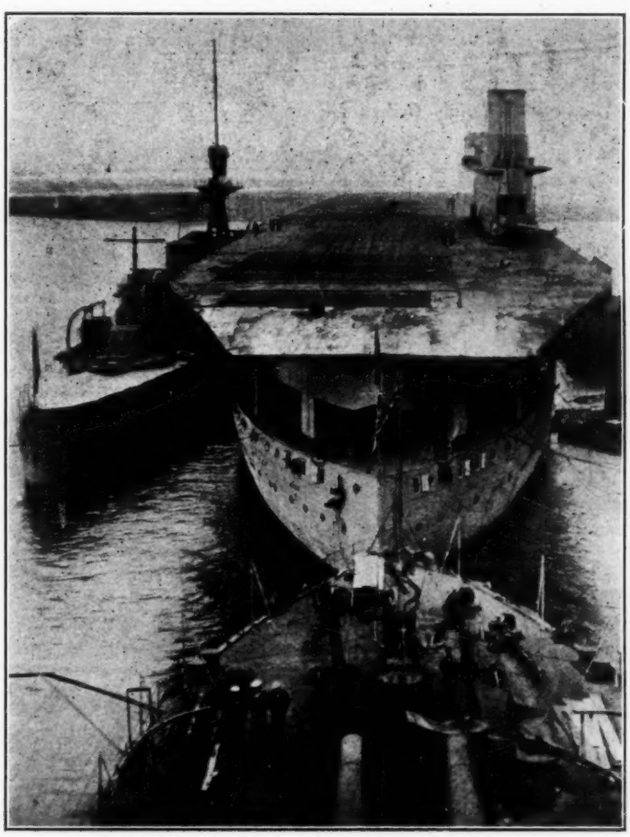
At the zero hour the bombing squadron and such other planes as are necessary for reconnoitering purposes will be at the shore base in all respects ready to proceed to the attack.

The attack will be delivered in he shortest possible time after the zero hour.

5. The Commander-in-Chief will issue necessary detailed instructions and will appoint a Board of Observers to observe and make detailed report of the exercise. He will also detail the necessary observing ships.

The position of all bombs dropped will be plotted as accurately as possible using the bombing rake. In addition to any other subject of interest, the board will submit data on the following subjects:

(1) Standard time of zero hour.
(2) Standard time at which position of target was determined by air force.
(3) Standard time at which bombing squadron was sighted.
(4) Number and type of bombs carried by each plane.
(5) Number of planes making the attack.
(6) Time at which first bomb was dropped.
(7) Time at which last bomb was dropped.
(8) Total number of bombs dropped.
(9) Altitude at which bombs were dropped.
(10) Sketch of bombing formation.
(11) Plot of fall of all bombs.
(12) Chronological report by Commanding Officer, Bombing Squadron.
(13) Probabilities of destruction of aircraft by surface vessels under conditions simulated by this attack.
(14) Probability of lessening liability of hits by bombs by maneuvering of ship.



THE LANDING AND FLYING-OFF DECK OF THE NEW BRITISH AIRCRAFT CARRIER "EAGLE"
Photo International

(15) Ability of aircraft to carry out successful search and deliver atack at considerable distance off shore.

6. The Commander-in-Chief shall notify the Department as soon as practicable of the date set for the beginning of this experiment, and of the number of aircraft, by classes, of the Air Force that will be available. The number of other aircraft available will then have been determined, of which the Commander-in-Chief will be informed, and the Bureau of Ordnance will then be able to proceed with the preparation of the required number of dummy bombs of various types. If requested by the Commander-in-Chief, technical experts from the Department will, if practicable, be given orders to report to the Commander-in-Chief for temporary duty in connection with this exercise. Observers from the Department will in any event be present.

7. It is the intention of the Department that certain experimental long range gun firing against the Iowa will also be conducted as soon as practicable in accordance with instructions to be issued later, but it is desired at this time to obtain the views of the Commander-in-Chief as to when a 14 in. gun battleship of the Atlantic Fleet could be made available for this very important duty.

Secretary Daniels Orders Destruction of Enemy Ships

In view of the decision of the Conference of Ambassadors which necessitates destruction of the ex-German surface vessels in the custody of the U. S. Navy during the period between May 1, 1921, and August 9, 1921, the Commander-in-Chief, U. S. Atlantic Fleet, is hereby directed to make such preparations as are necessary and to accomplish their destruction by bombing, gunfire, aircraft, or depth charges, as follows:—

Three Ex-German Destroyers: On a date between June 1 and July 15, 1921; to be designated by the Commander-in-Chief, the ex-German destroyers will be towed to sea and sunk in water not less than fifty fathoms deep. One destroyer shall be attacked and, if practicable, sunk by aircraft using 230 lb. Mark 1 bombs.

Ex-German Light Cruiser Frankfurt: On a date between June 1 and July 15, 1921, designated by the Commander-in-Chief, the ex-Frankfurt will be towed to sea and sunk in water not less than fifty fathoms deep. First attack; available seaplanes make simultaneous attack in any formation using 250-lb. heavy case bombs. If insufficient hits are obtained, the attack may be repeated as necessary, using other bombs of reserve supply as necessary.

Second attack; available seaplanes make simultaneous attack in any formation using 520-lb. case bombs. If insufficient hits are obtained, the attack may be repeated as necessary.

After each attack producing hits, an examination will be made to determine the damage resulting therefrom. After the completion of the examination of the damage resulting from these bombing attacks, if the Frankfort is still afloat, she will be attacked by gun fire from one division of destroyers.

Ex-German Battleship Ostfriesland: On a date between June 1, 1921 and July 15, 1921, Ex-Ostfriesland will be towed to sea and sunk in water not less than fifty fathoms deep. Available seaplanes make bombing attacks with heavy case 250-lb. bombs, heavy case 550-lb. bombs, 1000-lb. Navy bombs, and with bombs carrying heavier charge if any such bombs are available.

In these attacks aircraft may operate singly or in groups, but for each attack with 1000-lb. or heavier bombs only one bomb shall be dropped, and for each attack with the lighter types not more than two bombs shall be dropped. Attacks shall continue until at least three hits have been made with 250-lb. bombs, two hits with 550-lb. bombs and two hits with 1000-lb. or bomb of heavier charge. In case a sufficient number of hits have not been made with these bombs other attacks will be made utilizing the reserve supply of bombs. If neither of the hits with the 1000-lb. or heavier bombs explodes on the 75 1B. deck, which is the deck at the top of the casemate armor amidships, it is desired that one or more of this type of bomb be exploded statically on that deck, in order that the extent of damage to a deck of this thickness may be determined, particularly the damage downward through the deck.

Upon completion of the attacks with 250-lb., upon completion of the attacks with 550-lb. bombs, and after each hit with a heavier bomb, an examination will be made to determine the amount of damage resulting therefrom.

Upon completion of these examinations, if the ex-Ostfriesland is still afloat, she shall be attacked by gun fire, one 14 in. gun battleship attacking with turret guns and service ammunition at a range of not less than 18,000 yards.

In view of the great value of the information that may be obtained regarding the effect of bombs and gunfire on vessels of comparatively recent design, every effort should be made to obtain the maximum amount of useful information from these exercises. If during or after the bombing tests it should develop that more profitable information might be obtained from exploding bombs on turret tops, alongside the turrets or conning tower, or in any other special location, it is desired that this can be done by static explosions. If aircraft, additional to those available in the Air Force, are considered necessary, recommendation of the classes and number is requested, and effort will be made to assign them from other detachments.

The Commander-in-Chief will appoint a Board of Observers and provide transportation and observing vessels. If requested by the Commander-in-Chief, technical experts from the Department will be given orders to report to the Commander-in-Chief for temporary duty in connection with these experiments. Observers from the department will in any event be present.

It is desired that the Board of Observers shall

(a) Observe and report the number and type of bombs dropped, the height from which each bomb is dropped, and its point of fall.

(b) Observe and report the action of bombs, projectiles and depth charges that are expended.

(c) Observe and report the actual effect and damage to the ships, bearing in mind the age of the ships, their state of preservation and their date of design, under three general headings:

(1) Probable damage to personnel.

(2) Damage to anti-aircraft guns and defenses, and to light equipment and structure exposed on the topsides.

(3) Damage to the main fighting equipment (particularly lighting and control systems), and to the main structure of the ship.

(d) Make such deductions as can reasonably be made based on the consideration of facts coming under (c) (1), (2) and (3) as to probable effect and damage to ships of new design and good state of preservation in the several classes of men-of-war and auxiliaries.

(e) Make such recommendations as may be suitable, after consideration of (a), (b), (c), and (d), for the improvement of the various classes of ships of the Navy in equipment, material, design, and construction.

Rake observations, aerial photographs, motion pictures, and still pictures should be made for the purpose of locating the fall of shell and bombs, ascertaining and recording damage sustained by the targets, and for use in the analysis of the results of the exercises. It is extremely important that the information contained in the report of the Board should be carefully edited, locations of hits marked on plans of the ship which will be furnished the Commander-in-Chief as far as possible, photographs positively identified, and all data set forth in such form that erroneous conclusions may not be drawn.

The Commander-in-Chief, U. S. Atlantic Fleet shall, at the earliest practicable date, inform the Department of the scheduled dates and localities for these exercises, the ships and aircraft designated or recommended to conduct them and the place where and time when the bombs and depth charges are to be delivered. The Bureau of Ordnance will then designate the service ammunition to be used and will supply the following bombs:—50 Mark IV aero bombs, 90 230-lb. Mark I bombs, 34 heavy case 250-lb. bombs, 80 light case 520-lb. bombs, 34 heavy case 550-lb. bombs, 10 1000-lb. Navy type or bomb or heavier charge.

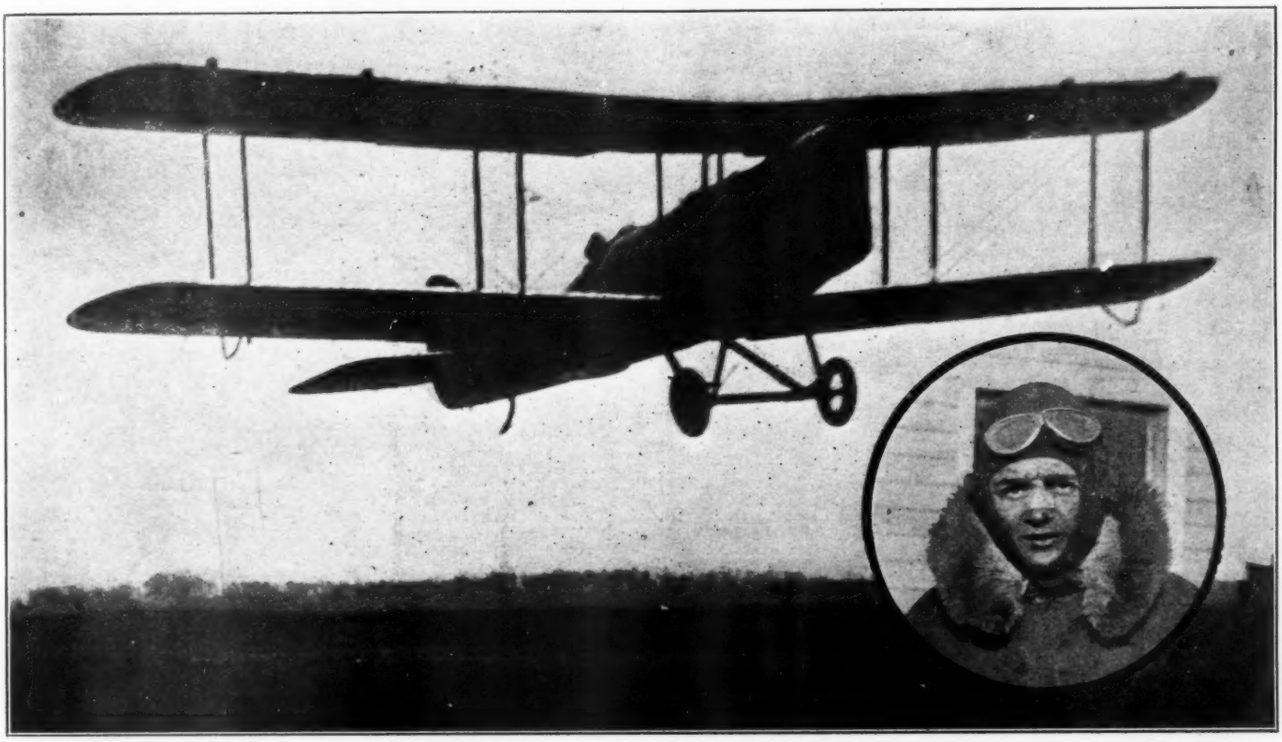
Handley Page Service Stopped

The Handley Page air transport service between London and Paris was discontinued March 1 owing to a great reduction in rates by the French companies, which made competition impossible.

San Francisco to New York in 33 Hrs. 20 Min.

The United States Air Mail Service added another chapter to its long line of achievements when, in Feb. 23, Mail Pilot E. M. Allison delivered mail at Hazelhurst Field, Long Island, 33 hr. 20 min. after it had left Montgomery Field, San Francisco. The same type of airplane, a D.H.-4M, driven by seven pilots, made the entire trip of 2,650 miles.

The shortest previous time for delivering mail across the continent was seventy-two hours by a combination of airplane and fast mail train. Before the air mails were started, four and one-half days was rapid time for an all rail trip.



THE END OF A GREAT NIGHT FLIGHT: MAIL PILOT JACK KNIGHT (SHOWN IN MEDALLION) LANDING AT DAYBREAK AT MAYWOOD FIELD, CHICAGO, FEB. 23

Photo International

Four Ships Start in Race

Four ships started on the test— two east bound, from San Francisco to New York, and two west bound, New York to San Francisco. One east bound flier—Capt. W. F. Lewis—was killed when his plane crashed to earth at Elko, Nev. The mail he carried was delivered, however. It was picked up at Elko by the other east bound flier and brought as extra weight.

The west bound planes were unfortunate in "bucking into" bad weather. One was forced to land at Dubois, Pa. Another reached Chicago, but because of storms the test flight was abandoned.

800 *Miles Flown by Night*

One of the most important things this experiment demonstrated was the feasibility of night flying. This was mainly responsible for the great saving of time effected in carrying the mail from the Pacific to the Atlantic.

The section from Cheyenne to Chicago, a distance of 800 miles, was entirely flown between sunset and sunrise, with an intermediate landing at 1 a. m. at Omaha. The greater part of the night trip, from North Platte, Neb., to Chicago, was made by mail pilot, Jack Knight. His performance was the more remarkable as he had never before flown between Omaha and Chicago, and weather conditions were extremely trying.

This experiment in night flying was made to determine the practicability of continuous flying on the coast to coast route between New York and San Francisco, without a layover at night. The pilots undertaking the night flying volunteered for this service, no pilot being required to take the night flight under orders. In addition to the night flight between Cheyenne and Chicago, the flight from San Francisco over the Sierra Nevada mountais to Reno was mostly done in the dark, and partially at an altitude of about 18,000 ft.

Pilot Nutter left San Francisco at 4:29 a. m. (P. T.) Feb. 22, arriving at Reno at 6:45 a. m. There the mail was transfered to another ship in ten minutes, pilot Eaton leaving Reno at 6:55 a m., and ariving at Elko, Nev., at 9:24 a. m., where a change in ships was made in seven minutes with the same pilot. Leaving Elko at 9:31 a. m. he arrived it Salt Lake City at 11:30 a. m. (M. T.) Here a change in ships and pilots was made in seven minutes, also, pilot Murray leaving Salt Lake City at 12:37 p m. (M. T.), arriving at Cheyenne at 4:57 p. m. At Cheyenne a change in planes was made in two minutes, pilot Yager leaving there at 4:59 p. m., and arriving at North Platte at 7:48 p. m. At North Platte some delay was caused by the necessity of replacing a damaged tail skid. Pilot Knight flew the plane from North Platte to Chicago, leaving North Platte at 10:44 p. m., arriving at Omaha at 1:10 a. m., Feb. 23, leaving Omaha at 1:59 a. m. and arriving in Chicago at 8:40 a. m. (C T.) today.

Pilot Knight's report on this night flying says:

"Left North Platte at 10:44 p. m., cloudy, moon shining intermittently from behind broken cloud layers, but had no particular trouble following course through use of compass and occasional glimpses of ground and river. Arrived Omaha 1:10 a. m., left 1:59 a. m. Delay at Omaha due to studying route Omaha to Chicago which I had never flown. Visibility fair until about Des Moines, where I encountered fog and

snow flurries lasting to Iowa City. Lost ten minutes at Iowa City locating town and field and remained there until I got weather report from Chicago as weather was bad. Between Iowa City and Chicago the weather was bad until about 2:30 a. m. when it began improving slowly and was comparatively clear at 5 in the morning."

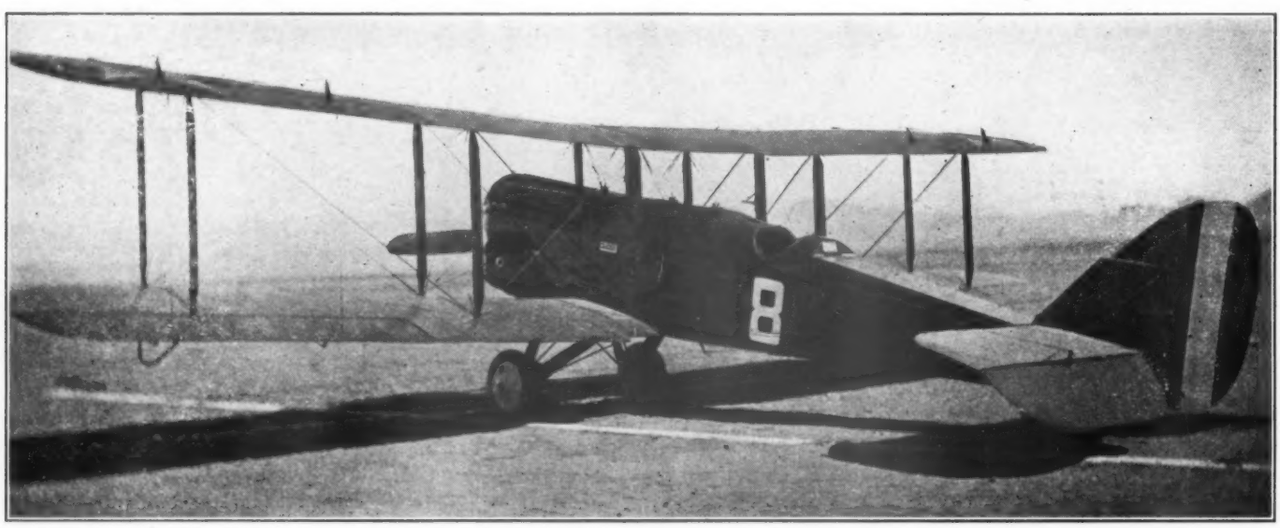
Pilot Webster left Chicago in another plane at 9 a. m. (C. T.) arriving in Cleveland at 12:52 p. m. (E. T.). The flight between Chicago and Cleveland was made at the rate of 105 miles per hour. Pilot Allison left Cleveland for New York at 1.03 p. m. (E. T.), where he arrived at 4:49 p. m. (E. T.).

This is the first of a series of try-outs to shorten the time for carrying the mail between San Francisco and New York. It is expected that on May 1, if present plans are carried out, night flying will be regularly established along this route and mail between San Francisco and New York will be delivered in approximately thirty-six hours, covering the whole distance across the continent. In reckoning the time of flight allowance must be made for the difference in time amounting to three hours between San Francisco and New York. In flying from San Francisco east pilots have an advantage in the prevailing winds and a handicap of three hours added time. Those sailing from New York to San Francisco have an advantage in time and a disadvantage in prevailing wind.

First One-Stop Flight Across the United States

Early in January the Chief of Army Air Service announced that on Feb. 22 an attempt would be made to cross the United States by airplane in a period of twenty-four hours, thus establishing a new trans-continental speed record.

The original schedule called for a flight of 2,079 miles, from Rockwell Field, San Diego, Calif., to Pablo Beach, Jacksonville, Fla., with a stop at Ellington Field, Houston, Tex. This would have cut the journey into two legs of 1,275 miles and 804 miles, respectively. Lieut. William D. Coney, 91st Aero Squadron was to make the flight from the west, while Lieut. Alexander Pearson was to start from the east, both flying specially rebuilt D.H.-4 army airplanes.



View of the Special D.H.4 on which Lt. W. D. Coney Made his One-Stop Trans-America Flight in 22 Hr. 30 Min. Flying Time

Photo U. S. Army Air Service

Lieutenant Coney's machine, re-fitted at Mather Field, had the front seat removed and the controls mounted in the rear seat. In the place of the front seat three extra gasoline tanks were installed, which increased the fuel supply of the D.H.-4 to 294 gal., sufficient for 14 hours flying. Underneath the fuselage a 30-gal. oil tank was mounted.

Lieutenant Coney's Flight

Shortly before the flight it was announced that Lieutenant Coney would stop at Love Field, Dallas, Tex., instead of at Ellington Field, because the former affords more complete repair facilities.

Lieutenant Coney took off at Rockwell Field on Feb. 21, at 7 p. m. in his attempt to cross the United States within twenty-four hours. He carried, beside a package of official mail from the commander of the San Diego naval air station to the commander of the Pensacola naval air station, two bottles of hot coffee and 4 lb. of chocolate. The use of a hot liquid was particularly advisable in view of the all-night trip, where drowsiness might have fatal results.

The following morning, having outridden heavy snow and rain storms over New Mexico, the pilot was forced to land owing to shortage of fuel at Bronte, Tex. There he experienced difficulty in re-fuelling and the gasoline he finally obtained was of such inferior grade that the Liberty engine refused to start. Delay in getting high grade gasoline kept Lieutenant Coney on the ground until nightfall, when he again took off, risking a second all-night flight in a dogged attempt to make good his loss of time.

His efforts were rewarded by success when he landed on the morning of Feb. 24 at 7:27 a. m. at Pablo Beach, having spanned the United States in 22 hr. 30 min. flying time. The total elapsed time from coast to coast was, owing to fuel shortage, 36 hr. 27 min.

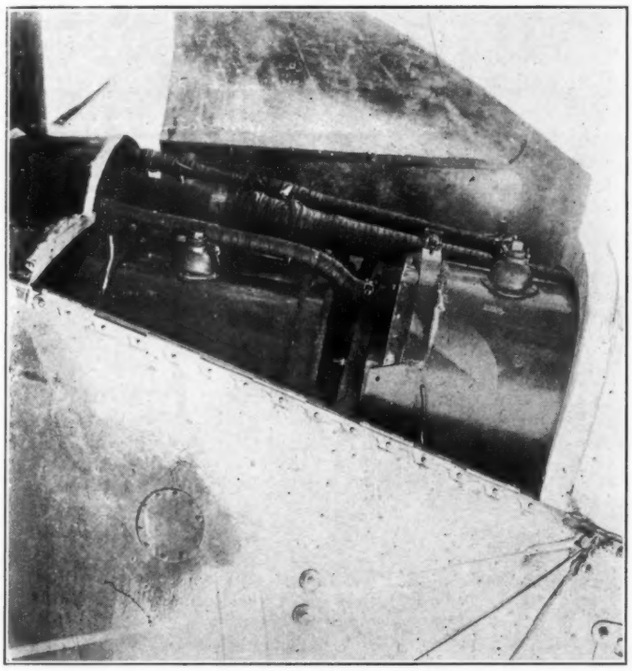
In discussing the journey Lieut. Coney states that he attained the greatest height when passing over the Mississippi River, when he rose 17,000 feet to escape a heavy fog. In passing over the Rockies, although believing himself high enough to miss any treacherous mountains, he almost sent his De Haviland against a snow capped peak which he barely saw in time to pass around. He was making 200 m.p.h. at the time.

Lieut. Pearson had less luck in his attempt, for he experienced engine trouble en route and had to land for repairs. This required too much time to make it worth while resuming the flight.

Lt. W. D. Coney's Carreer

Sec. Lieut. William D. Coney, Air Service, was born in Atlanta, Ga., on Nov. 20, 1893. His education was received at the Georgia Institute of Technology.

The month after the United States engaged in the war—in May, 1917—Lieutenant Coney entered the first Officers' Training Camp at Fort McPherson, Georgia, from which camp he was transferred to the Aviation Ground School at the Georgia Institute of Technology on July 10, 1917. On Sept. 8 of the same year he was sent to Essington, Pennsylvania, where he received flying training. During the latter part of Oct., 1917, he was sent to Kelly Field, San Antonio, Texas, where after graduating on Jan. 8, 1918, he received a commission as Second Lieutenant in the Air Service. At Kelly Field he acted as flying instructor from the date of his graduation until Oct. 1919, when he received orders to proceed to a port of embarkation in New York preparatory to going over seas for active military duty. Due to the signing of the armistice, however, orders covering his sailing were revoked, and he was sent to Carlstrom Field, Arcadia, Fla., on Dec. 22, 1918. Here he again acted as flying instructor, and was also a member of the Testing and Engineering Department at this field.



THE EXTRA TANKS OF LIEUTENANT CONEY'S TRANS-AMERICAN D.H.-4
Photo U. S. Army Air Service

Ordered to Washington on May 15, 1919, Lieutenant Coney served as a member of the Information Group in the office of the Chief of Air Service until Feb. 8, 1920. At this time he was sent to Mather Field, Sacramento, Calif., where he was assigned to the 91st Aero Squadron, of which he has been a valuable officer up to the present time.

Lieutenant Coney has rendered efficient service on duty with a detachment of the 91st Squadron in the southern part of the state in connection with the aerial border patrol operating between United States and Mexico. He further proved his value to the Air Service by accomplishing exceptionally fine work during the past season as an aerial forest fire patrol pilot operating out of Medford, Ore.

New Aero Engine Silencer

According to the New York *World* the Army Air Service has received from Maj. H. S. Burwell, commanding officer of the air station at Weissenthurm in the Coblenz area, a report regarding the performance of an aero engine muffler invented by Mr. Berger of Zurich, Switzerland.

Major Burwell spent three days at Dubendorf, Switzerland, witnessing the demonstration of this new invention. He was convinced after the tests that the invention has considerable practical value. Apparently it did not heat up or diminish the power of the engine but reduced the volume of the staccato exhaust noises sufficiently to allow conversation between the pilot and passenger.

Major Burwell described the fundamental principle of the apparatus as being simple, consisting only of a marked rapid cooling of the exhaust gases which action, as well as that of the explosion of the burned gases from both the manifold and the muffler, was assisted by a sharp suction created by small revolving blades and by centrifugal motion generated in either a connection on the camshaft or from small exterior blades around the movable head of the streamlined muffler operating in the slip stream.

The gases enter the tapered rear end of the silencer into sleeves similar to an automobile muffler and are sucked and thrown out of the spinning head of the front end, resulting in well over 50 per cent reduction in noise, plus a blended and smoother sound hardly audible at an altitude of 2,000 ft. This was tried when a Benz motor of 200 hp. was used.

The natural disadvantage is that of increased head resistance which Major Burwell regarded as objectionable, although the inventor claimed that the muffler could be practically enclosed in an oval case placed close to the bottom or top of the motor.

Major Burwell has recommended that the Air Service purchase or construct several types of this muffler for experimental purposes.

The inventor claims that his present hand made model is sufficiently perfected and efficient to permit an instructor and primary student to converse freely in flight, to make lower unexpected bombing raids possible, allow pilot and observer to work easily together and alleviate the difficulty of tuning wireless telephone sets over the noise of the motor and to allow plain code signals by use of the motor cut-out to be sent from the plane to the ground.

European Air Mails

By use of the Paris Air Mail, packets for Switzerland, Italy, South Eastern Europe, Spain and Portugal, will connect with the Night Mail trains from Paris on the same day, and will, in many cases, reach their destinations twenty-four hours earlier. Packets for Poland posted too late for inclusion in the ordinary Mails despatched from London on Monday, Wednesday and Saturday nights, but in time for inclusion in the Air Mails despatched on Monday, Tuesday or Wednesday, Thursday or Friday, should gain from two to three days down to eighteen hours in delivery.

By use of the Brussels Air Mail, packets for countries beyond will connect with the Night Mail trains from Brussels and packets for South Germany (Frankfort, etc.), Austria and Hungary should gain from six to twenty-four hours in delivery. Acceleration of packets for North Germany, Denmark, Sweden and Norway is not afforded.

Packets for India, Egypt, Aden, East Africa (Kenya Colony, etc.), Ceylon, Straits Settlements, Hong Kong and in certain weeks Australia if posted in time for the Air Mail from London to Paris on Friday should overtake the ordinary Mail despatched from London on the previous evening. As the Friday Air Mail is liable not to be despatched in the event of bad weather, packets for India, etc., should not be marked and prepaid for Air Mail transmission when they are in time for transmission (without payment of late fee) by the ordinary Mail on Thursday; and Air Mail packets which come to hand after the despatch of the Air Mail on Wednesday will be sent, when possible, by the ordinary Mail on Thursday. Packets for Egypt may also be accelerated if posted for transmision by Air Mail to Paris on other days of the week (except Thursday).

It is interesting to note that the following limitation has to be placed on the size of aerial express packages. Goods of any description that come within the following weights and sizes can be forwarded at any time by air to the continent through Handley Page Transport, Ltd.: Anything up to four feet cube, not exceeding 3½ cwts. in weight, or 12 feet in length by 12 inches in width and depth, not exceeding 2,000 lb. in weight, or anything six feet long by 2 feet in width and 2 feet in depth, not exceeding 2,000 lb. in weight.

Bids for MB-3 Pursuit Airplanes and Spares

When, during a recent hearing on the Army appropriation bill Brig. Gen. William Mitchell stated that the United States now had an American pursuit airplane equal in performance to any foreign machine, he alluded to the Thomas-Morse MB-3, which with a 300 hp. Wright engine won second place in the Pulitzer Trophy Race on Thanks-

	50			100		
	Unit Price	*Total*	*Grand Total*	*Unit Price*	*Total*	*Grand Total*
(*a*) Aeromarine Plane and Motor Co. Keyport, N. J.	$11,090.00	$552,500.00		$ 9,437.00	$ 943,700.00	
	spares	50,803.00	$603,303.00	spares	101,606.00	$1,045,306.00
	Deliveries completed in 6 months			Deliveries completed in 7 months		
(*b*) Bethlehem Aircraft Corp. Bethlehem, Pa.	$12,138.00	$606,900.00				
	spares	76,244.50	$683,124.50			
	Deliveries completed in 10½ months					
Boeing Airplane Co. Seattle, Wash.	$10,175.00	$508,750.00		$ 8,036.00	$ 803,600.00	
	spares	48,248.46	$556,998.46	spares	77,196.45	$ 880,796.45
	Deliveries completed in 9 months			Deliveries completed in 12 months		
Curtiss Aeroplane and Motor Corp. Garden City, N. Y.	$10,927.00	$546,350.00		$10,228.00	$1,022,800.00	
	spares	55,258.75	$601,608.75	spares	102,735.75	$1,125,535.75
	Deliveries completed in 11 months			Deliveries completed in 11 months		
Dayton Wright Co. Dayton, Ohio	$12,288.00	$614,400.00		$11,366.00	$1,136,600.00	
	spares	73,935.00	$688,335.00	spares	136,250.00	$1,272,859.00
	Deliveries completed in 11 months			Deliveries completed in 14 months		
(*c*) Eberhart Steel Products Co. Buffalo, N. Y.	$10,706.00	$535,300.00		$ 8,035.00	$ 803,500.00	
	spares	41,398.40	$576,698.40	spares	82,796.80	$ 886,296.80
	Deliveries completed in 8 months			Deliveries completed in 10 months		
(*d*) G. Elias and Bro. Buffalo, N. Y.	$13,000.00	$650,000.00		$12,800.00	$1,280,000.00	
	spares	60,000.00	$710,000.00	spares	120,000.00	$1,400,000.00
	Deliveries completed in 15 months			Deliveries completed in 19 months		
Gallaudet Aircraft Corp. East Greenwich, R. I.	$10,975.00	$548,750.00				
	spares	68,724.32	$617,474.32			
	Deliveries completed in 10 months					
L. W. F. Engineering Corp. College Point, N. Y.	$ 9,949.55	$497,477.50		$ 9,651.00	$ 965,100.00	
	spares	87,175.00	$584,652.50	spares	165,632.50	$1,130,732.50
	Deliveries completed in 6 months			Deliveries completed in 7 months		
(*e*) Longren Aircraft Corp. Topeka, Kan.	$ 9,436.88	$471,844.00				
	spares	69,164.12	$541,008.12			
	Deliveries completed in 9 months					
Lawrence Sperry Aircraft Co. Farmingdale, N. Y.	$ 9,950.00	$497,500.00				
	spares	77,622.00	$575,122.00			
	Deliveries completed in 6 months					
Thomas-Morse Aircraft Corp. Ithaca, N. Y.	$10,950.00	$547,500.00		$ 9,525.00	$ 952,500.00	
	spares	54,363.00	$601,863.00	spares	94,768.00	$1,047,268.00
	Deliveries completed in 6 months			Deliveries completed in 8½ months		
(*d*) Waterman Aircraft Mfg. Co. Venice, Cal.	$ 7,940.00	$397,000.00		$ 7,850.00	$ 785,000.00	
	spares	35,500.00	$432,500.00	spares	70,000.00	$ 855,000.00
	Deliveries completed in 6 months			Deliveries completed in 9 months		
Wittemann-Lewis Aircraft Co. Hasbrouck Heights, N. J.	$17,900.00	$895,000.00				
	spares	104,351.25	$999,351.25			
	Deliveries completed in 13 months					

giving Day and over a measured course established an average speed of 170¼ miles per hour. To supply the Army Air Service's absolute lack of Pursuit machines the Engineering Division at McCook Field called for bids on the MB-3 in lots of 50, 100, 150 and 200 machines with necessary spares in each case. These bids were opened February 21. Fourteen manufacturers have submitted bids on 50 machines while nine of the same manufacturers have bid on each of the lots of 100, 150 and 200 machines. These bids disclose that the average total price on 50 machines with spares is $639,574.24; while the average total price on 200 machines is $1,945,263.23.

	150			200		
	Unit Price	*Total*	*Grand Total*	*Unit Price*	*Total*	*Grand Total*
(*a*) Aeromarine Plane and Motor Co. Keyport, N. J.	$ 8,575.00	$1,286,250.00		$ 8,144.00	$1,628,800.00	
	spares	152,409.00	$1,438,659.00	spares	203,212.00	$1,832,012.00
	Deliveries completed in 8 months			Deliveries completed in 10 months		
(*b*) Bethlehem Aircraft Corp. Bethlehem, Pa.						
Boeing Airplane Co. Seattle, Wash.	$ 7,260.00	$1,089,000.00		$ 6,617.00	$1,323,400.00	
	spares	101,321.77	$1,190,321.77	spares	125,445.97	$1,448,845.97
	Deliveries completed in 14 months			Deliveries completed in 15 months		
Curtiss Aeroplane and Motor Corp. Garden City, N. Y.	$ 9,494.00	$1,424,100.00		$ 8,958.00	$1,791,600.00	
	spares	143,224.25	$1,567,324.25	spares	190,965.50	$1,982,565.50
	Deliveries completed in 11 months			Deliveries completed in 13 months		
Dayton Wright Co. Dayton, Ohio	$10,454.00	$1,568,100.00		$ 9,829.00	$1,965,800.00	
	spares	188,100.00	$1,756,200.00	spares	235,800.00	$2,201,600.00
	Deliveries completed in 14 months			Deliveries completed in 15 months		
(*c*) Eberhart Steel Products Co. Buffalo, N. Y.	$ 7,600.00	$1,140,000.00		$ 6,950.00	$1,390,000.00	
	spares	124,195.20	$1,264,195.20	spares	165,593.60	$1,555,593.60
	Deliveries completed in 12 months			Deliveries completed in 14 months		
(*d*) G. Elias and Bro. Buffalo, N. Y.	$12,700.00	$1,905,000.00		$12,600.00	$2,520,000.00	
	spares	180,000.00	$2,085,000.00	spares	240,000.00	$2,760,000.00
	Deliveries completed in 21 months			Deliveries completed in 19 months		
Gallaudet Aircraft Corp. East Greenwich, R. I.						
L. W. F. Engineering Corp. College Point, N. Y.	$ 9,296.00	$1,394,400.00		$ 9,187.00	$1,837,400.00	
	spares	235,372.50	$1,629,772.50	spares	296,395.00	$2,133,795.00
	Deliveries completed in 7 months			Deliveries completed in 8 months		
Thomas-Morse Aircraft Corp. Ithaca, N. Y.	$ 9,025.00	$1,353,750.00		$ 8,762.50	$1,752,500.00	
	spares	134,694.00	$1,488,444.00	spares	173,457.00	$1,925,957.00
	Deliveries completed in 10½ months			Deliveries completed in 12 months		
(*d*) Waterman Aircraft Mfg. Co. Venice, Cal.	$ 7,775.00	$1,166,250.00		$ 7,700.00	$1,540,000.00	
	spares	103,500.00	$1,269,750.00	spares	136,000.00	$1,676,000.00
	Deliveries completed in 12 months			Deliveries completed in 15 months		

(a) Prices adjusted to include royalties, not included in bid.
(b) Discount 2 per cent—10 days; 1 per cent—20 days; ½ per cent—30 days.
(c) Prices adjusted to include packing and crating, not included in bid.
(d) Discount 1½ per cent—10 days; 1 per cent—20 days; ½ per cent—30 days.
(e) Discount 3 per cent—10 days; 2 per cent—20 days; 1 per cent—30 days.

Safety in Aviation

By E. Stockton Martin

Manager, Aircraft Department, Home Insurance Co.

The term "Safety in Aviation" while it has been recognized in the construction and operation of planes during the past year, should be heralded as never before at the opening of the flying season this spring. We have every reason to believe that aviation in this country has passed through the stages of doubt and has become recognized as a practical means of transportation. Government authorities have shown this recognition in a number of ways. The Post Office Department has been severely criticized for delivery of mail by air but in spite of all opposition is continuing this service and has capped the climax by safely carrying mail across the continent from San Francisco to Mineola, L. I., in thirty-three hours and 20 minutes, a distance of 2,700 miles at an average speed, including stops, of 81 m.p.h. This record is one of which the Post Office Department may well be proud but is an accomplishment which has developed after a loss of many pilots since the beginning of the Air Mail Service in May, 1918, and a loss of planes valued at thousands of dollars.

Some af these casualities were unavoidable and were only the natural outcome of a new enterprise. However, a great many of them could have been avoided if only the proper precautions had been taken. If proper care is taken by mechanics who are in charge of the ship and the pilot is familiar with the plane there is no reason why casualities should occur.

The experience record of insurance companies covering ships of the De Haviland type has been very unsatisfactory and the loss ratio has been so high that it is almost impossible to secure coverage for this type of ship, yet De Haviland plane No. 74 used in the Mail Service has flown 38,381 miles in 420 hr. and 15 min. and is still in operation across the Sierra Nevada mountains from Reno to San Francisco, a route over which no more serious test could be given to a plane. The experience records of the insurance companies show a large percentage of losses attributed to mechanical defects of the plane or motor failure on this type of ship. The fact has been proved that with conservative operation and expert mechanical care ships of this type may be flown thousands of miles without mishap.

Statistics made up by the insurance companies show that approximately 23 per cent of all losses can be attributed directly to carelessness and poor judgment on the part of pilots or mechanics in the operation of planes which are insured. After a careful analysis of losses, it has been found that reports of mechanical defects of the plane or motor are merely the outcome of total lack of attention in the upkeep of the ship. After an inspection by competent aircraft adjustors it has been found in many cases where motor failure has been the cause of the loss that a carburetor was clogged, or in some cases where mechanical defects have been reported it has been found that loose or weak joints have been allowed to remain in poor condition until they finally broke in the air causing the ship to crash and endangering the lives of the pilot and passengers. Out of the 23 per cent of the total losses reported by one insurance company as being attributed to carelessness and poor judgment, 30 per cent of these losses were caused by pilots landing in small fields, not through motor failure but in a reckless chance that they could make the field without crashing the ship. 30 per cent were caused through bad landings and take offs which can be attributed either to inability of the pilot operating the machine or to utter carelessness. 17 per cent were caused by flying too close to the earth. 8 were caused by cutting the motor too soon and trying to stretch the glide. 15 per cent were caused by stunting at low altitudes. Stunting in itself is not dangerous if carried on at a sufficient height, but the daredevil stunting which has prevailed for a long time is a detriment to aviation and is bound to cause casualities sooner or later.

Insurance is automatically serving as a safety control in the operation of aircraft, yet the insurance companies in themselves can only play a small part in placing aviation on a sound basis. The insurance program for the coming year has been carefully laid out and, because of the lack of any apparent interest on the part of the Federal Government for the control and operation of aircraft, has sought to at least control pilots and planes which are covered by insurance. Arrangements have been made for the classification of all types of aircraft, landing fields, pilots, and general flying. Thorough inspections will be made of each type of plane manufactured or sold in the United States for construction, factor of safety, quality of material used in manufacture, general specifications such as performances of landing and take off, useful load, structural strength and other specifications which enter into the classification for insurance purposes. An historical report will be obtained of the experience record of each type of plane from the time it is first manufactured until the present time, showing the experience in the use of the plane for the Army and Navy and for civil purposes. A certified record will also be obtained of each pilot now operating in the United States and a certificate will be issued after his experience has been checked up, giving his classification. These records will be kept on file at the National Aircraft Underwriters Association office and all pilots must take the rating which has been given them when they are submitted for insurance. After a pilot has been examined for a certificate, insurance companies have agreed to refuse coverage to all who are not eligible. When a loss occurs to any plane which is insured, a full record of the loss together with the name of the pilot who was operating the plane at the time of the loss will be filed, and if the cause of such a loss can be attributed to carelessness or inability on the part of the pilot, his insurance certificate will be revoked and it will not be possible for him to secure further insurance or for others to secure insurance who employ him as a pilot to operate their ships. In this manner the insurance companies at least will rid themselves of careless and inefficient pilots.

If the term "Safety in Aviation" could be carried in the minds of all pilots, mechanics, and manufacturers during the coming year, the greatest obstacles which are now confronting the development of aeronautics will be removed and it will be less difficult to secure capital for experimental purposes and appropriations for national defense in the use of planes for the Army and Navy.

Pacific Cruise of Navy Air Force

Twelve seaplanes of the Pacific Fleet Air Force which recently made their memorable flight from San Diego to the Canal Zone, left Balboa Feb. 23, 1920, for Bahia Honda on the first leg of the return trip to San Diego.

The itinerary of the air force is as follows: Balboa to Bahia Honda, Bahia Honda to Punta Arenas, Punta Arenas to La Union, La Union to Chipequa Bay, Chipequa Bay to Acapulco, Acapulco to Santiago Bay, Santiago Bay to Marie Midre Island, Marie Midre Island to Magdalena Bay, Magdalena Bay to Sanbartolome Bay, Sanbartolome Bay to San Diego.

The Atlantic Air Force has already reached Great Corn Island on her return trip up the east coast and was expected to reach Truxillo, Mexico, a distance of 630 miles, Feb. 23. From there she will fly due east for the naval base at Guantanamo, Cuba.

On this return trip the Atlantic Fleet Air Commander had an interesting problem in air navigation to overcome. The trade winds at this time of the year blow in a southwesterly direction from Cuba to Panama, with considerable force, about 30 m.p.h., and it would be impossible, therefore, for the aircraft to travel on the return trip along routes they took in going to Panama, as the winds would hold them back at the rate of thirty miles an hour. A plan was evolved, therefore, to fly up the coast of Mexico until arriving at a point east of Cuba, and then to strike out for Guantanamo going in an easterly direction and then going around the dangerous trades.

Two-Seater Avro Baby, Type 543

This airplane is a development of the little 35 hp. single-seater Avro Baby biplane, type 543 which has put up a remarkable series of performances during the last eighteen months by winning the London Aerial Derby Handicap in 1919 and in 1920 and by making a 7-hr. non-stop flight from London to Turin, crossing the Alps enroute.

Except for the longer cockpit and the slightly further forward position of the engine, which has been so placed in order to balance the weight of the passenger, the two-seater Baby is practically identical with the single-seater Baby.

Specifications

The following is a summary of the technical data of the two-seater Avro Baby:—

Span of top plane	25	ft.
Span of bottom plane	23	ft.
Chord of planes	4	ft.
Gap between planes	4	ft. 3 in.
Stagger of planes	1	ft. 6 in.
Length overall	20	ft.
Height overall	7	ft. 6 in.
Span of tail-plane	7	ft. 6 in.
Chord of tail and elevators	3	ft. 5¼ in.
Area of planes and ailerons	176½	sq. ft.
Area of tail and elevators	22¼	sq. ft.
Angle of incidence of planes	4½	deg.
Dihedral angle	3	deg.
Weight bare (with water)	630	lb.
Weight loaded	970	lb.
Surface loading	5.5	lb. sq. ft.
Engine loading (40 hp.)	24.2	lb./sq. ft.
Petrol capacity	8	gal.
Oil capacity	1½	gal.

Performance

The following performances were obtained from the average of a number of carefully conducted test flights carried out at the Hamble Aerodrome, near Southampton:—

Maximum speed (sea level)	82	m.p.h.
Maximum speed: at 6,600 ft.	77.5	m.p.h.
Maximum speed: at 10,000 ft.	72.5	m.p.h.
Landing speed	40	m.p.h.
Stalling speed	40	m.p.h.
Cruising speed at 1,000 ft.	70	m.p.h.
Gasoline consumption cruising at 1,000 ft.	2½	gal. per hr.
Duration cruising at 1,000 ft.	3.2	hr.
Cruising range	225	miles
Climb to 1,000 ft.	2¼	min.
Climb to 2,000 ft.	4½	min.
Climb to 5,000 ft.	13	min.
Climb to 6,600 ft.	18½	min.
Climb to 10,000 ft.	35	min.
Ceiling 12,000 ft. in	50	min.

From the above figures it will be seen that this machine is very efficient and the ease with which it can be landed in and flown out of small fields makes it particularly suitable for country flying. The machine is reported as light and quick on the controls at high and low altitudes.

It is claimed that it can be flown equally well without a passenger, and can perform all the "stunts" which are expected of modern airplanes.

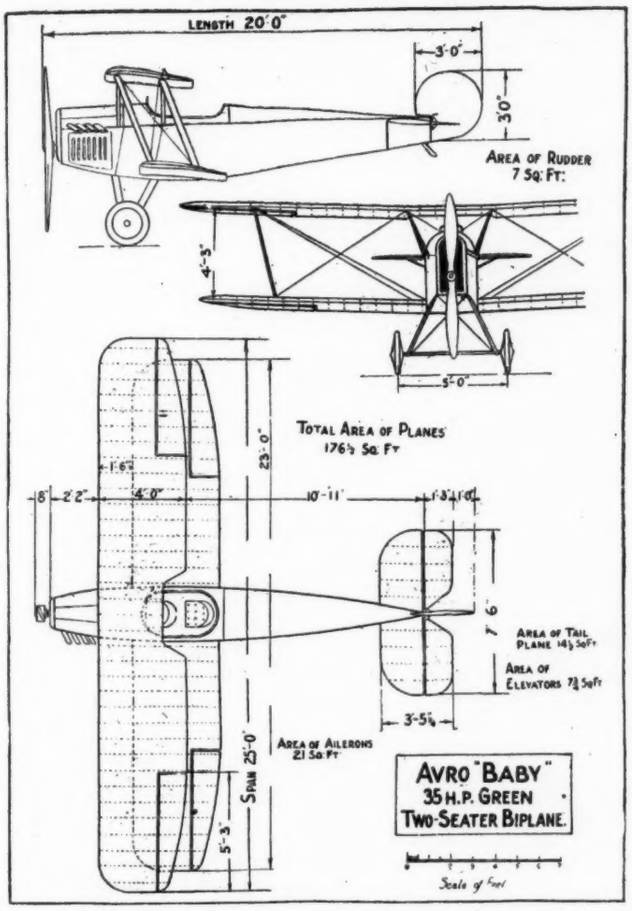
Construction

The under carriage is of the Vee type with a split axle, hinged in the center. The chassis is entirely constructed of steel tube, faired off with light 3-ply fairings, which are, in turn, covered with linen, doped and painted. The wheels, fitted with Palmer cord tires 600 by 50 mm., are sprung by the usual rubber shock absorbers, while the track, 5 ft., is wide for such a small machine.

The tail skid is made of ash, with a steel shoe, and is also sprung with rubber shock-absorbers.

The planes are built up in the Avro manner, the main spars being of built-up box section with spindled wooden leading edge and tubular steel end sweeps and trailing edges. The ribs, of girder construction, are placed close together so as to retain a good wing form and R.A.F. 15 section. Small nose ribs are placed between each of the main ribs. Internal bracing is by means of high tensile steel wire and Avro turnbuckles. Compression struts are formed of strong box ribs, as in the standard Avro type.

Only one pair of interplane struts is used on each side of the body, and the lift wires are splayed out so as to attach to the body over a wide length, thus distributing the lift loads along the body and also assisting the internal bracing of the



OUTLINE DRAWING OF THE TWO-SEATER AVRO BABY

wings to take the drag loads. The center section struts, which are splayed out in front view, are made of streamline section steel tube.

The fuselage is built up on the conventional box girder system with spruce longerons and struts and steel wire bracing, Avro body sockets and strainers being employed. It is of ample proportions, and the cockpit is roomy for so small a machine. Two seats of the bucket type, with upholstered cushions are fitted, and the engine and machine controls are conveniently placed, the engine control being on the pilot's left hand. A 3-ply floor covered with aluminum sheet forms the heel rest for the pilot's feet, the rudder bar being so arranged that the pilot can change the position of his feet slightly so as to use either the instep or toes on the rudder bar. The body is faired off and covered with linen, doped and varnished; it is laced on, so that it can easily be removed for inspection. Although the deck fairing in front of the pilot's cockpit renders it unnecessary to wear goggles, a folding windscreen is fitted.

Rudder bar and rudder controls are of the usual Avro type, and the control stick consists of a single steel tube universally

mounted at the base. The aileron control wires are taken direct from the control stick, and the elevators are operated through a rocking cross-shaft which is coupled up to the control stick by means of a pull and push rod connected to the control stick by universal joints. All control cables are standard stranded cable passing through fairleads. Pulleys are entirely eliminated from the control system, and pulley crank levers are employed where it is necessary to change the direction of the control cables.

One of the new 35-45 hp. Green 4-cyl. vertical water-cooled engines is fitted. It drives a 7 ft. 6 in. diameter by 5 ft. 3 in. pitch tractor airscrew at a maximum speed of 1,500 r.p.m. in the air.

A honeycomb radiator is mounted in the nose of the fuselage.

Principles of Radio Communication for Aircraft

The following principles of radio communication for aircraft covering the fundamentals for inter-department radio control have been formally approved by the War Department, Navy Department, Post Office Department and Department of Commerce and Labor. These principles were formulated by representatives from the several departments.

(a) Radio Stations belonging to the various departments of the government should be made available for use of other departments and should be utilized by those other departments wherever practicable for communication between the landing field and aircraft.

(b) When such communication is not available, the department concerned should erect its own station at the airdrome. Such stations should use the latest and most modern equipment, conforming to the international agreements, and using tunes to be agreed upon.

(c) As a general rule, no department of the government should erect radio transmitting stations (except radio beacons) within twenty miles radius of another government radio station. Where existing government radio stations are within twenty mile radius of a landing field, provisions should be made for the remote control of such station from the landing field. For example, in places similar to Cleveland, where there is a naval radio station near the Post Office airplane landing field, arrangements should be made to control the Naval Radio Station from the Post Office landing field.

(d) Any department of the government should have full authority to establish radio beacons at its own airdromes. These beacons should be limited in range to thirty miles along the coasts and border; and should be limited to a range of fifty miles in the interior of the country, except in extreme cases where it would be a loss of economy to erect a multiplicity of radio beacon stations.

(e) All departments of the government concerned in areonauties should cooperate in matters pertaining to the collection and dissemination of meteorological data for aircraft.

(f) As a general rule, the radio stations should not be utilized for communication between airdromes, but should be reserved for communication between aircraft and airdromes.

(g) There should be standard specifications for radio beacons in the United States, and these specifications should be compiled by technical representatives of the departments interested; and where applicable, should conform to international requirements.

(h) As a general rule, radio beacons should be installed by the government, and the Post Office should install and provide for the operation of radio beacons for airplanes along the regular air mail routes, and at public landing fields along such routes used in common with any department of the government. The Army and Navy should install radio beacons at their own landing fields.

(i) In the case of private landing fields, the Post Office Department should not be required to establish a radio beacon, but in the case of the establishment of such beacons, the Department of Commerce should require the private individual to install a radio beacon conforming to the standard specifications.

(j) When once radio beacons are established, they shall be available for use to all aircraft during peace times.

(k) The Post Office, the Army, the Navy, and the Department of Commerce should endeavor to obtain legislation from Congress providing for the establishment of a National Radio Commission to regulate all Radio communication in the United States and its possessions.

(l) If it is impossible to obtain legislation from Congress in the near future, there should be established by the President an Inter-departmental Board consisting of representatives from the Army, the Navy, the Department of Commerce and the Post Office. The function of this board should be to endeavor to provide means by which the radio communication systems of the government could operate without interference with one another or with private radio communication.

British Aircraft Competitions, 1920

The following is an excerpt from a report issued by the British Air Ministry on the British Aeronautical Competitions, which were held during August and September last, with the object of ascertaining the best types of airplanes and amphibians which would be safe, comfortable and economical for air travel, and in case of the amphibians, capable of alighting on and rising from water as well as land.

One effect of the rules of the competitions was to encourage the production of aircraft having an ample reserve of power. To obtain this reserve without sacrificing economy or useful load entails the use of an engine of high power for its weight, but normally run well below its maximum power. The advantage thus attained in regard to safety is clearly shown in the greatly increased ability to arise out of a confined space, while the reduced normal strain on the engine largely assists in producing a reliable machine.

In spite of the higher first cost of such an aircraft it is almost certainly a better commercial proposition than a machine with the same normal performance and little or no reserve of power.

As regards landing in a confined space, the pilot's view and the controllability of the machine are two very important factors, and there is some tendency to place upon them insufficient weight.

The run on the ground after such landings can be reduced if suitable wheel brakes are fitted, and very promising designs were exhibited by some competitors.

The precautions taken by designers to avoid any risk of fire in the air and largely to reduce the risk of fire in the event of a crash showed that this important point had received due attention, and ideas embodied in competing machines will be of definite value in future designs.

The amphibians also displayed a marked advance toward safety in another direction. Capable of alighting on and rising from any practicable site on land or water they have a great advantage over other forms of heavier-than-air craft, while the low positions of the hull very largely reduces any risk of injury in the event of a minor accident on the ground.

This type of aircraft has a high potential value for commercial purposes as its use will in many cases very much shorten the distance to be flown and also enable passengers to be landed on a river in the heart of a city instead of on an aerodrome some considerable distance outside.

In regard to twin-engined machines, further information was gained as to the conditions determining their ability to fly on one engine, and it was clearly shown that, given adequate attention to certain details of design, a twin-engined machine can fly on one engine, thereby increasing its reliability and safety.

Aircraft designed for commercial use show a marked advance in comfort over those originally designed for war purposes and afterwards modified to suit civil requirements. Seating accommodation, heating and ventilation arrangements have reached a very fair standard of comfort, but in this respect the question of silencing the engines has not yet had sufficient attention. The design of aircraft as affecting their economical use is of great importance commercially, and in this respect the competitions brought forward many excellent points in detailed design.

The reduction in the number of parts subject to wear, and the increased accessibility of those requiring attention was attained in competing machines to such an extent as to offer a considerable improvement in economy of maintenance.

Flying Weather in the Southern Plains States

By John A. Reihle, Meteorologist

The economic importance of the wind in commercial aeronautics calls for complete data on this meteorological element based on a systematic distribution of regular observations. This work was started years ago in this country, but received added impetus when wind observation by means of pilot balloons was begun by the Signal Corps during the war. These observations are now conducted by the Weather Bureau as a part of the permanent work of aerological investigations. The records have added much to our knowledge of the seasonal and geographical distribution of the winds in the free air, and will be of increasing value with the growth of aviation.

Pilot balloons furnish, perhaps, the most available method for measuring the wind aloft for flying purposes, their usefulness being precluded only by the conditions that interfere with flying, namely, fog, low clouds, and precipitation. They have the advantage over kites in that either very high or very low velocities may be measured, while kites can not rise through a calm stratum and are blown away if the wind is too strong. Furthermore, the data are quickly available after the observation is made.

The Southern Plains States lie well to the south of the average storm tracks. Winters are comparatively mild, and a large proportion of the time throughout the year is favorable for aviation. Surface winds blow very steadily from the south during the summer; but during the winter there is nearly a balance between the north and south winds, with the result that winter means at Broken Arrow show a southerly component and those at Fort Sill a slight northerly component. The depth of the southerly component increases from winter to summer, and velocities decrease at the same time.

A rapid increase in velocity from the ground to approximately 500 meters occurs at all seasons; above this there is little or no increase to 1,500 meters, and there may be a decrease as occurs in all seasons except winter at Fort Sill. Above 1,500 meters there is a nearly constant increase to at least 10 kilometers. The decrease in velocity above 500 meters is sometimes caused by a rapid shift in direction, but occurs also when there is little or no change in direction. It is not the result of convection because it is most marked in the early morning when vertical currents are at a minimum. No satisfactory explanation of this phenomenon has been found, but it is suggested that surface pressure systems, which exert a shallow influence in this region, may interact with the general circulation to interrupt the normal increase aloft.

Westerly winds, as is generally known, increase with altitude; easterly winds continue light to an indefinite altitude or shift to west. This shift may be a gradual veering through south and southwest, or a sharp line may divide the lower easterly and the overrunning westerly winds.

Changes—Annual, Diurnal, and Irregular

The march of the wind has three characteristics—annual, diurnal, and irregular. Highest velocities occur in winter, except that in the first kilometer they may occur in spring; lowest velocities at all altitudes occur in summer.

During the early morning an observation of the surface wind gives little indication of the wind aloft. In the morning the velocity may increase from light on the ground to gale force within a few hundred meters. On the morning of March 27, 1920, the wind increased from 8.5 m/s at the surface to 30 m/s at 500 meters and 34 m/s at 900 meters. During the day convection and turbulence tend to remove such irregularities and to bring about nearly the same direction and velocity throughout the first kilometer.

Irregular changes in velocity at any level are the result of changes in the horizontal pressure gradient at that level. Winds near the ground result from passing HIGHS and LOWS, but at moderate altitudes the free-air winds are determined primarily by the surface temperatures, and the cause of abnormal winds aloft is generally to be found in an abnormal surface temperature distribution, in its effect on the free-air pressure distribution.

Abnormal Winds Aloft

Present-day aviation is most concerned with the winds of the first 2 kilometers, but in view of the discussion among fliers of the possibilty of flying at enormous speeds by taking advantage of the winds at high altitudes a brief summary of these winds seems desirable. During the two years' records at Broken Arrow seventy-one balloons have been observed to the 10-kilometer level (32,808 ft.), and the velocities found there are certainly ample to carry the flier well on his way provided he can maintain the altitude. By applying the gradients from 6 to 10 kilometers to the velocities at 6 kilometers, the velocities indicated for 10 kilometers are: Spring, 38 m/s.; summer, 17 m/s.; autumn 28 m/s.; and winter, 47 m/s. The number of winter observations is too small to afford entirely reliable means, but the annual mean, 33 m/s., agrees quite well with the determination of cirrus cloud movements at Blue Hill and Washington. The percentage of westerly winds has decreased somewhat, but this is more apparent than real, because the balloon rising in a west wind generally passes beyond the range of visibility before reaching this altitude.

But even the strong westerlies of winter are interrupted at intervals by light winds which at times have an easterly direction so that the aviator who is equipped for high-altitude flying and desires to use the strong westerlies is still dependent on the meterorologist for the prediction of their occurrence.

A few instances of extreme velocities have been recorded. On Dec. 17, 1919, at Lansing, Mich., a velocity of 81 m/s. was observed at 6 kilometers. On March 13. 1920, at Broken Arrow a velocity of 84 m/s. was observed at 6,200 meters. Such velocities are to be accepted with reservation because of the possibility of an error due to a leaky balloon, but the similarity of the surface temperature distribution and the velocities observed tends to prove the essential accuracy of these two observations. They are most unusual and occur only in the winter half-year when the pole-ward temperature gradients greatly exceed the normal. On these two dates there was a temperature difference of 56 deg. C. between southern Florida and the northern Lake region.

Conditions Unfavorable for Flying

High winds.—Surface winds in this region are seldom strong enough to prevent an experienced aviator from taking off or landing with safety, but winds of sufficient force to be a serious obstacle to economical flying into a head wind sometimes persist for one or two days at a time in winter and early spring. At this season the highest surface velocities generally occur from noon to 2 p. m. These winter winds, because of wide distribution and persistence, can be determined and their effect on the course of an airplane can be foretold with reasonable accuracy.

In summer, on the other hand, such winds seldom occur, but the wind feature of most danger to aviators is the squall winds that accompany thunderstorms. These winds sometimes attain a velocity of 30 m/s. for a short time, and are most frequent from 3 p. m. to 5 p. m. Forecasts of squall winds and thunderstorms, on account of their short duration and the limited area covered, can not well be made on the Weather Bureau report, except to state that conditions are favorable for their occurrence. They usually occur in the southern quadrant of a "low" or near the wind shift line of a V-shaped depression, and move in an easterly direction over a path from a few to 500 kilometers or more advancing at a rate of 50 to 60 kilometers per hour.

Aviators should study the structure of thunderstorms, and the direction of the attendant winds in relation to the path of the storm, bearing in mind that with the onset of the squall the surface wind usually veers from a southerly to a northwesterly direction. Dr. Brooks has pointed out the danger of

* Excerpt from the *Monthly Weather Review*.

attempting to fly through a thunderstorm due to lightning and the violent turbulence of the air. As a rule the aviator should be able to see the approaching storm in time to make a safe landing before the arrival of the violent squall wind. Capt. C. K. M. Douglas in "Clouds as seen from an Aeroplane," says: "A thunderstorm 100 miles away is a conspicuous object from the air, and the top of 'anvils' may sometimes be seen from 10,000 ft. at a distance of about 200 miles. Thunderstorms can nearly always be avoided without difficulty by airplane pilots engaged in ordinary peace-time flying. The higher the pilot flies the more conspicuous the tops of the thunder clouds become, and the more easily can they be avoided. Sometimes there are extensive clouds at about the base of the thunder clouds and it is necessary to climb above them in order to see the thunderstorms at a distance, and to judge the best course to fly in order to avoid them."

Fog, clouds, and rain.—Dense fog stops flying, not only because it makes safe landing impossible, but it prevents the taking of observations of the wind aloft which would assist the aviator in steering an accurate course above the fog. Persistent fogs are, however, infrequent, and are confined mostly to early winter when the vapor content of the air is being reduced by falling temperatures. The most frequent unfavorable condition for flying is the presence of low stratus clouds, often at an altitude of less than 500 meters and in many cases accompanied by precipitation. Flying beneath such clouds is inadvisable because of the danger of having to make a forced landing within a limited area and the chance for accident because of surface obstructions. Furthermore, intermittent precipitation when the temperature is slightly below freezing will cause an accumulation of ice and make a forced landing unavoidable. For a discussion of the advantages of flying above and below the clouds reference should be made to "Over-Cloud Flying and Commercial Aeronautics," AVIATION, June 15, 1920.

A record of the number of times that balloon runs were not made because of adverse weather gives a rough estimate of the frequency of these conditions. There are approximately 14 per cent of winter days and 7 per cent of summer days that are some what unfavorable for flying; and 10 per cent of winter days and 2 per cent of summer days that are decidedly unfavorable.

Best altitude for flying.—The aviator who finds himself without a daily wind report will find the tables of seasonal averages of value in selecting the best altitude for flying. In summer the wind is usually unimportant, but in winter, because of the large percentage of strong westerlies aloft, the aviator will find it best to fly high, above 1,000 meters, on an eastward trip and low on a westward one. For the same reason cross winds will be encountered in north and south flying and low altitude is again advisable. However, of strong head winds are found while flying north or south the following condition is likely to occur: A rapid increase in velocity from the ground to an altitude of 500 to 1,000 meters, with a decrease, sometimes very rapid, at higher altitudes; and it will be best to try to find a region of lighter wind at elevation of 1,500 meters or more. This is an early morning condition and leads us to the next paragraph.

Best time of day for flying.—Flying in winter may often be done best near midday or in the afternoon because of the presence at times of morning fogs or low stratus clouds which are dissipated by the rising sun. Also, at ordinary flying altitudes wind velocities are less than in the early morning. In summer morning hours are best because the wind is steady, visibility is good, and local storms are not likely to occur; while in the afternoon turbulence sets in (bumpiness in flying) and this process may continue until thunderstorms are formed. Turbulence is caused by rough topography, buildings, the meeting or flowing past each other of air currents of different direction and density, and causes many of the peculiar phenomena of the air that the aviator has to face. These are dealt with fully by Prof. Humphreys, in "Physics of the Air", Chapter XI, pages 214-225. In a level country the principal cause of turbulence is daytime convection or the rising of heated air from the surface to a height of a kilometer or more by a process analogous to the rising of gas bubbles in boiling water. When a rising mass becomes large enough its upper limit is marked by a cumulus cloud. The cloud may soon dissipate or it may grow to large size, depending on the temperature and moisture of the rising air. Cumulo-nimbus clouds and thunderstorms are the culmination of this process.

To what extent the air may be disturbed by convection on summer afternoons, even though there is no approach to thunderstorm conditions, may be seen from the following. On June 25, 1920, two ascents were made at short intervals, and the position of the balloon was computed at the end of each minute by the two-theodolite method. Both balloons had nearly the same ascensional rate by formula, that of the first being 161 m/m and of the second 160 m/m. The first balloon, released at 2:46 p. m., rose at an average rate of 171 m/m, having been affected only slightly by convection. The second was released at 3:12 p. m., directly underneath a rather large cumulus cloud. A convectional gust caught the balloon as it left the ground, and from the end of the first to the third minute the ascensional rate was 422 m/m, or 264 per cent of the rate by formula. This gives an upward movement of the air around the balloon at a rate of 4.4 m/s. Such vertical gusts, usually much less marked, are the cause of "bumps" experienced on warm afternoons. If such a sustaining force were suddenly removed from an airplane the sensation would be that of a "hole in the air".

Another German Aviation Combine

The Handley Page Berlin correspondent reports another German aviation combine for linking up the cities of Eastern Germany with Berlin. It is known as the Lloyd-Ostflug-Danzig, and is a combination of the North German Lloyd of Bremen, Junkers Flugzeugwerke of Dessau, the Albatros Gesellschaft and the Ostdeutsche Landwerkstatten. Dantzic is to be one of the centers of operation, and a regular service is already in operation between that port and Koenigsberg and thence to Berlin. Negotiations are proceeding with a view to an agreement for flying over the Polish corridor. The passenger rate between Dantzic and Berlin is to be 900 Marks, including carriage between the various aerodromes. Junkers limousines are to be employed in the service and arrangements have been made so that passengers may book at any of the branches of the North German Lloyd.

In reviewing the progress of German aviation during 1920 the correspondent considers that German aviators have cause for jubilation in view of the undoubted difficulties experienced by the industry. The press generally views the position with satisfaction and points out to the German public that in spite of the paralyzing methods adopted by the inter-allied Commission on aviation the following services are in existence:—Berlin, Bremen, Hamburg, Muenster, Magdeburg, Leipzig, Munich, Augsburg, Nuremberg, Stuttgart, Konstanz and extensions to Denmark, Sweden and Holland.

Associations of all kinds are being urged to insist upon absolute freedom in the air for German aviation in order to stiffen the Government in their negotiations with the allies. Meanwhile there are indications of still greater activity during 1921, a service between Magdeburg and Breslau has been inaugurated and Cologne is waking up to the fact that it should be the center for aerial transport in Western Germany. An agitation is already on foot to establish an extensive airport there on the lines of that adopted for Bremen, provided, of course that the allies do not put a veto on the proposal. At the moment airships are under a cloud and public interest is centered in airplanes. It is reported that 1921 will see the adoption of heavy oils in place of the expensive petrol for motive power and inventors are busily engaged on devices for reducing the consumption of fuel.

Quick Adjustable Clamp

The Vitek Manufacturing Co. of Chicago, Ill., has come out with a new hose clamp said to be an improvement over any previous designs. Its particular advantages are simplicity and speed of application and adjustment, which are dependent on the turning of a single wing bolt. The clamp, made of soft spring steel, adjusts itself to the proper curvature as the bolt is screwed down. There are no nuts or other parts which can come off. A locking pin could readily be inserted in the bolt, but we doubt whether this will be found necessary, as the back pressure of the hose against the bolt makes it practically self-locking.

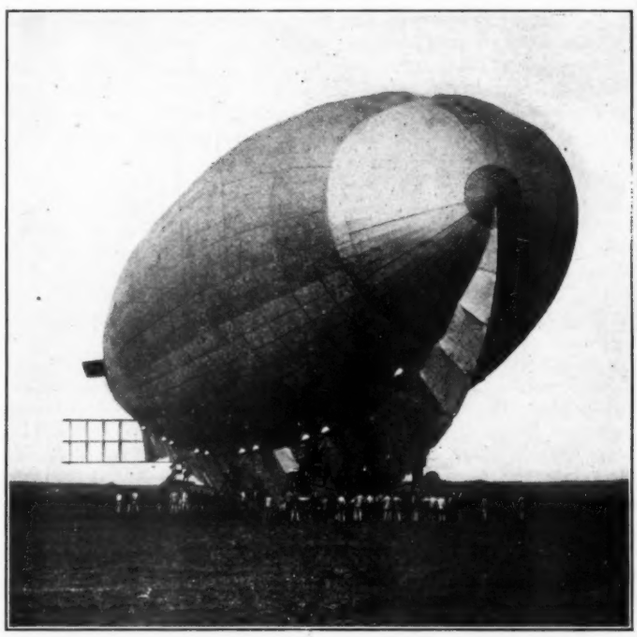
Italian Semirigid Airships Observed at Front

The following story, written by Arthur Halsted, associate electrical engineer in the Bureau of Standards, Washington, D.C., and, during the war, an officer in American Air Service, serving with the Italian forces in the Po Valley, is of unusual interest since it sets forth the advantages of the semi-rigid airship especially in night bombing:

Between Oct. 23 and Nov. 15, 1918, inclusive, I was at the Italian Front attached to the 202 Squadron of Italian marines.

The field at which this squadron was stationed was under the Commando Aviazione a Disposizione (The Italian Independent Air Force) and was headquarters for two squadrons of Caproni triplanes piloted by Italians. Within 10 kilometers of this field was located a semi-rigid airship field under the Italian Navy. I understand that there were four dirigibles about 100 meters long in the vicinity, although I personally saw only two.

Location and Climate Conditions. These fields were in the Po Valley within 30 kilometers of Ferrara. The land was low lying with a tendency to be marshy although covered by a highly developed drainage system. Because of the prevalence of air currents drifting down the valley from the Alps, fogs and ground mists were frequent. In fact during my stay there,



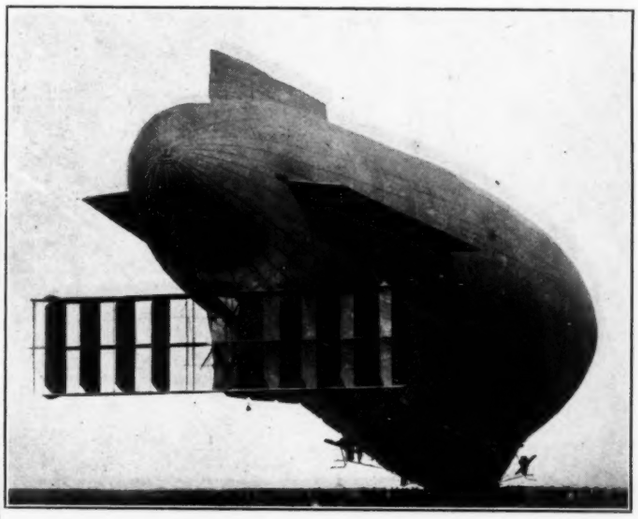
ITALIAN SEMIRIGID AIRSHIP ROMA, PURCHASED BY THE U. S. ARMY

every afternoon between four and six p.m. the ground was blanketed in fog which did not disperse until the next morning after sunrise, often persisting until ten or eleven a.m. This nightly fog served effectively to protect the aviation field and dirigible hangars from enemy night raids.

Operations. On the days when weather conditions permitted, from six to ten bombing airplanes left the field at about midday to return here before four in the afternoon, each carrying from 1000 to 1500 kilograms of bombs. Every evening *regardless of weather conditions or fog,* these dirigibles started out for a trip into enemy territory carrying much greater loads of bombs and returned successfully with the morning. In every instance, the dirigibles, without a serious hitch in the schedule, started on and returned from their mission in 100 per cent of force. In comparison with this record, in practically no raid participated in by six or more airplanes did all the planes return to their base the same day. Usually one or more was delayed for days or weeks, due to forced landings, at fields nearer to the front lines. I am not aware, however, of any airplane from this base being brought down or captured by the enemy.

In my training I did many hours of flying under almost all flying conditions at night and may say with some authority that on not one of the nights during my stay at this field could an airplane have carried through successfully a night mission.

Bomb Dropping. For accurate bomb dropping from an airplane it is necessary to fly level at a known altitude, and to maintain a uniform velocity with reference to the ground previously measured by a trial bomb sight. I understand from my companions, officers in the Italian Army, that the dirigibles aided by reversible pitch propellers and covered by the night and the almost complete silence of their engines and



THE STERN OF THE ROMA, NOTABLE FOR ITS CELLULAR RUDDER AND ELEVATOR

operations, established a position practically at rest vertically above the target before releasing the bombs. Before bombs reached the ground and exploded or any evidence of the presence of the dirigibles was suspected by the enemy, all engines were opened up and the airships were under full headway for home. Their speed was about 100 kilometers per hour.

It was understood from conversations with Italin officers that the execution of these dirigibles was more destructive than could be accomplished even by formations of airplanes.

Visibility at Night. From experience in flying over cities in the raid areas at night, I may safely say that there is no way of hiding a city or railway yards even in the darkest nights with no moon and a sky covered with clouds. The cities observed were lighted with the minimum number of blue lights, having the lighting units so covered by opaque shades so as to hide every source from above. The outlines of the cities, parks and railway yards were nevertheless distinguishable, especially the railway yards by the lines of light reflected from the top surfaces of the rails.

Method of Returning to Base. The dirigible observed in operation returned to their base in spite of weather conditions with unerring regularity. Observations and conversations seemed to establish about the following procedure.

The base was located easily and practically within a radius of say twenty miles or less by dead reckoning. The dirigibles then hovered about this location until the mists should rise with day or the hangar was otherwise definitely located. If wireless was used for direction finding I did not discover it nor was I informed of it.

Towards morning at the hangars a large fire of gasoline and petroleum poured into a pit was lighted. The clouds of black smoke rising for a continued period through the still foggy

air seemed to penetrate eventually the fog which was impervious to the beam from a search light. During darkness the red glow from the burning pit seemed to be distinguishable from the airship and during hours of light probably a black spot in the fog caused by the column of smoke. At any rate, before the fog had completely lifted with the day these dirigibles had all made a safe return to their hangars. The security and unerring regularity of their missions of destruction were almost uncanny to a pilot-aviator familiar with the mishaps and delays then inevitable in the operation of airplanes.

To Bring Back the Roma

The large semi-rigid airship Roma, which was recently purchased from the Italian government by the War Department will be brought to this country by an Air Service detail shown in the accompanying photograph.

AIR SERVICE DETAIL WHICH IS GOING TO ITALY TO BRING BACK THE AIRSHIP ROMA
Photo U. S. Army Air Service

Seated, from left to right, are Lieut. W. J. Reed, Maj. J. G. Thornell, Capt. Dale Mabry; standing, Sergt. J. M. Biedenbach, Sergt. V. C. Hoffman, Staff. Sergt. M. J. Beale, Master Sergt. H. A. Chapman, Master Sergt. R C. McNally.

Aerial Taxi is No Joke

That an aerial taxi is no joke in the eyes of the law was convincingly demonstrated the other day when the Municipal Court of New York awarded a judgment against a man who failed to pay an aerial taxi bill.

The suit came up in the Municipal Court before Judge John R. Davies. C. A. Lomas was the defendant. It was alleged that Lomas did not believe it possible to hire an airplane taxi-cab, and on August 4 last, ordered one "just for a joke". The aerial taxi was sent to the pier at Eighty-fourth Street and North River, but Lomas did not arrive.

A verdict of $25 and costs was given by Judge Davies against the defendant, the court ruling that an airplane taxi service is no more of a joke than motor service on the ground.

Mail Airplane Performance

According to an announcement made by the Post Office Department, the Air Mail had up to Dec. 31, 1920, flown more than one and a half million miles, or more than the distance around the earth at the Equator. The prize plane of these veterans of the air was D.H. No. 76, which had 38,348 miles in 407 hr. 8 min. before it went out of service in a bad crash on Oct. 16, 1920. The average speed of this plane was 94.4 m.p.h. The plane with the next greatest record was D.H. No. 74, which flew 38,381 miles in 420 hr. 15 min., and is still going strong across the Sierra Nevada Mountains from Reno to San Francisco. It is one of the planes that the Air Mail mechanics expect to see reach the ripe old record of 50,000 miles or better. Its average speed per hour was 89.1 m.p.h. through the entire period of its activities. This plane has added 3,443 miles to its record during the months of January and February. Four other De Haviland planes have each exceeded 30,000 miles of operation.

Next to these top-notchers in the mail service stand the two Curtiss R-4 planes. Of these, No. 31 had a record at the close of 1920 of 33,644 miles in 378 hr. 49 min. in the air. This is an average speed of 88.8 m.p.h. The second Curtiss R-4 plane with better than 30,000 miles was No. 35, which covered 30,948 miles in 397 hr. 25 min. in the air. This is an average speed of 77.9 m.p.h. Planes Nos. 31 and 35 are operating between New York and Washington today, and the former has an addition of 6,885 miles accumulated during the months of January and February.

The first airplanes used in the Air Mail Service on the date of its inauguration, May 15, 1918, were Curtiss JN-4 training planes. The first day of the service was opened with planes Nos. 11 and 12 of this type. Both of these planes are in operation today between St. Louis and Chicago. No. 11 has covered 31,208 miles in 468 hr. 28 min. of flying, an average speed of 66.7 m.p.h.; and No. 12 has covered 30,090 miles in 447 hr. 25 min. in the air, an average speed of 69.1 m.p.h.

The first planes purchased by the Post Office Department were eight machines manufactured by the Standard Aircraft Corp. of Elizabeth, N. J., which was in business only during the war. Seven of these planes are still in existence, two of them flying daily between Chicago and St. Louis. Their best record is 15,781 miles in 207 hr. 15 min., or an average of 76.3 m.p.h., for one plane; and 10,256 miles in 141 hr. 29 min, or an average of 72.4 m.p.h., for the other plane.

Two of the Glenn L Martin twin motor planes put into service in the winter of 1919 have exceeded 25,000 miles of service. Plane No. 201 of this type has run 27,757 miles in 363 hr. 46 min., an average of 75.3 m.p.h. Plane No. 202 has seen 25,593 miles of service in 287 hr. 18 min. in the air, an average speed of 89.2 m.p.h. Both of these two planes are being repaired and overhauled and give promise of getting into the 40,000 to 50,000 miles class.

The Junker all-metal monoplanes are the latest planes put in to the Air Mail Service. They have not had the mileage that should have been obtained from them, owing to the fact that these planes had serious engineering defects in their fuel system and engine installations. One of these planes has covered 7,677 miles between August and Dec. 31, in 94 hr. 41 min., an average of 81.1 m.p.h. A second of the all-metal monoplanes has run 6,159 miles in 87 hr 49 min., an average of 70.5 m.p.h. Both of these planes have additional mileage accumulated during January and February.

Up to Dec. 31, 1920, the planes in the Air Mail Service have been in the air 18,806 hr. 37 min. and have covered 1,572,450½ miles. This is an average for all types of planes under all conditions of operation of 83.6 m.p.h. In that period they have carried more than 49,000,000 letters. The mechanics time and the cost of airplane and repair parts over this entire period of service have been at the rate of 30.5 cents per mile flown.

In announcing this performance of the Air Mail planes, the Post Office Department makes it acknowledgment to the mechanics who are charged with repairing the planes and keeping them in condition for the daily flights with the mail, and to the pilots who have handled them with daring and judgment under most trying and adverse conditions of weather. Is is a performance far beyond the conception of the most optimistic authorities in aviation.

Rubber Aircraft Parts

By Edgar H. Wilson

President, Dural Rubber Co.

Among the most efficient accessories for airplanes are those made of rubber. They are not effected by high altitudes nor sea level conditions and if the plane meets with a mishap they are the last ruptured. This cannot be said of any other part used on a plane. Most parts can be duplicated with some other material, but the rubber products cannot. Just as rubber predominates in many lines of industry today, so the rubber parts on airplanes are becoming of increasing importance to their efficiency.

The first rubber equipment used on airplanes were fabric tires. These have been replaced by an efficient cord casing with tough tread and completely exposed side wall. Size, at this point, must be cut to the minimum because it forms head-resistance.

The inner tubes used in these casings are, likewise, very light but very strong and so encased that there will be a minimum amount of pinching. These tubes are equipped with special valves which are designed to protrude through the rubber covering, which surrounds the spokes of the wheel. The opening of this valve is equipped with a cap that will fit both the American and French air pump, merely by an interchange of cap.

The rubber grip handles for the joy stick are very light and of efficient construction and are used on stick control planes. Heavy day or night bombers use the "dep" or wheel control. This controlling wheel is made of vulcanized or hard rubber. The grip handles are made in three types. One is used in connection with Liberty Motor equipped planes and the other two in connection with the rotary motors where exposure of parts of the switch is mandatory in the end of the stick or joy control.

Rubber grommets or escutcheons are used in many places for running wires to the cowl, protecting the tachometer and speedometer shaft and are used in various sizes both round and oblong. They are arranged to hug the hole in which they are placed.

Development of a special line of aircraft hose has been a real test of the rubber industry. The hose is not used to any extent, but hot oil and gasoline hose are used in many places on aviation motors. This must perform without fail or serious accidents are bound to occur. Of course, various specificatinos for these hoses have been made up by the Air Service after competitive tests on various makes of hose. Recently a moulded and braided type of hose has made its appearance and in all tests it has been found more efficient than the other types. There has also been considerable development of the radiator hose. This must be light but yet efficient and resist high temperatures for long periods.

There are many rubber pads used throughout an airplane between the axle and its bed, between the tail-skid and the adjoining cross member, for reducing vibration of motors and at the base of the inter-plane strut. These have all proven their ability to assimilate punishment and save more important members from excessive wear.

Hard rubber radiator caps are of much the same construction of that used on automobiles and are used on many types. Insulated wires perform the same duty as on an automobile except they must be better protected and of greater efficiency.

Rubber is considered at some points a very efficient streamlining material. On some types of machines the axles and spreader tubes running parallel to it are completely covered by a rubber tube which expands during the landing of a machine and contracts as it leaves the ground, so that the head resistance of this member is at a minimum. Possibly the most efficient streamlining is accomplished at the tail-skid where a rubber bib is attached so that the hole in the fuselage is closed to air currents while in flight. This keeps foreign matter out while taxiing across the field.

Interplane wires have also been streamlined when they are parallel by a special constructed rubber tube, enclosing them. Tests have proven that wires so covered have less resistance than one wire uncovered, which is a material advantage, in cutting a head resistance and means a considerable increase in miles per hour and in petrol consumption. It also eliminates the vibration of wires without streamlining. There are also irregular rubber parts which cover control surface regulators for changing the balance of the plane while flying and disposing of its load of bombs.

Many types of shock absorbers have been tried and found wanting, but at the present time the rubber cord is used for the most part. When rubber was first adopted, a series of rubber rings were enclosed in a bridge on either side of the axle; but these were found cumbersome and of too great weight, and presented too much parasite head resistance. A lighter construction in connection with cord was obtained. The development of the shock absorber, however, is in its infancy and it is, in this field, that there is an abundant opportunity for improvement. The life of the rubber cord, which is composed of many small strands of rubber covered by a woven cotton case, is governed by the life of the cotton. When the covering breaks the efficiency of the cord is at an end. The greatest reason why the rubber cord is used is because of the peculiar hysteresis curve that it gives. In other words, it has great ability for absorbing shock in landing and taxiing across the field. The old type of rubber ring has very little hysteresis except when the stock is of such a nature that it could not come back and consequently took permanent set. Obviously a unit of rubber is elongated when a load is applied and if this returns promptly when the load is released, then there is no shock absorbing ability, because its action is equal in both directions. The new type of shock absorber mentioned above is made of rubber with all the advantages of the cord but with none of its disadvantages.

Because of the continous vibration of airplanes, petrol tanks and all delicate parts are guarded to some extent with rubber, either in washer or strip form.

Also, special designs of oil strips have been made for use in the head cowl of the rotary motors. These hinder the oil from spraying in the face of the pilot and not only add greatly to his comfort but to his safety as well. Then, too, there are rubber radiator collars, used when the shaft of the motor with the propeller fastened on the end, protrudes through the radiator. This rubber protects the delicate portion of the housing so that it will not be cut through by the harsher member under constant vibration. There have also been interesting tests made on a cover for a gasoline tank. The principle worked on is a rubber container that is so made that the stock on the inside of the rubber enclosing the gasoline tank is kept under pressure. When the bullets pass through this, it immediately closes retaining the fuel and permits the aviator to reach his lines with safety.

Rubber matting is much used, principally of the pyramid type, in place of aluminum. These moulded pieces of matting are used on the pedal bar, for foot control, in the foot holes and on the floors of the large bombers.

Rubber tubing as well as hose is essential. They are mostly confined to light tubing for conveying gasoline and oil under low pressure. There is, however, some acid tubing used. The pilots at some of the aviation fields have recently been interested in a rubber covering for themselves while in flight. This not only adds to their comfort but aids to some extent in streamlining the fuselage as well. One of the most important auxiliaries of an army aviator is the oxygen mask for high altitude. Without this helmet, the endurance of a pilot would be confined to what his physique would stand, whereas, under present conditions, it is only limited by the ability of the machine which he flies. The apparatus consists of the helmet which is similar to the present gas helmet used by the men, with the exception that pure oxygen is permitted to enter instead of the air passing through purifying substance as it does in the gas mask. There are also numerous pieces of rubber tubing that are built to stand long periods of oxidation. These are placed in the pipe lines at critical points where metal tubing cannot be used to advantage.

Names of Army Air Stations

The following list is of flying fields established by the U. S. Air Service before and during the World War. On November 1, 1919, some were used as storage depots and others had been discontinued.

The majority of these were named after flying officers who have been killed in line of duty, while flying. Unless otherwise mentioned the fields are in memory of those who met death in flight. Other fields were named after patrons and pioneers of aeronautics.

NAME OF FIELD	LOCATION	NAMED FOR	DATE OF DEATH
Barron	Everman, Tex.	Cadet Robert J. Barron	22 Aug., 1917
Bolling (1)	Anacostia, D. C.	Col. Raynal C. Bolling	29 March, 1918
Brindley	Commack, L. I., N. Y.	Maj. Oscar A. Brindley	2 May, 1918
Brooks	San Antonio, Tex.	Cadet S. J. Brooks	13 Nov., 1919
Call	Wichita Falls, Tex.	1st Lt. Loren H. Call	8 July, 1913
Camp Dick	Dallas, Tex.	Cadet Jas. F. Dick, Jr.	6 Jan., 1918
Carlstrom (2)	Arcadia, Fla.	Victor Carlstrom	9 May, 1917
Carruthers	Benbrook, Tex.	Cadet W. Keene Carruthers	18 June, 1918
Chandler	Essington, Pa.	2d Lt. Rex Chandler	8 Apr., 1913
Chanute (3)	Bantoul, Ill.	Octave Chanute	24 Nov., 1910
Chapman	Miami, Fla.	Victor Chapman	21 June, 1916
Clark	Philippine Islands	Maj. Harold M. Clark	21 May, 1919
Crissy	San Francisco, Cal.	Maj. Dana H. Crissy	8 Oct., 1919
Henry J. Damm	Babylon, L. I., N. Y.	Lt. Col. Henry J. Damm	2 May, 1918
Dorr	Arcadia, Fla.	Pvt. S. H. Dorr	17 Aug., 1917
East (4)	Olaymess, Cal.	Maj. Whittier J. East	2 Oct., 1918
Eberts	Lonoke, Ark.	1st Lt. Melchior Eberts	15 May, 1917
Ellington	Houston, Tex.	2d Lt. Eric L. Ellington	24 Nov., 1913
Emerson	Columbia, S. C.	Lt. W. K. B. Emerson	14 May, 1918
Florence (5)	Ft. Omaha, Nebr.	Florence, Nebr.	
France	Canal Zone	1st Lt. Howard J. France	24 April, 1918
Gerstner	Lake Charles, La.	2nd Lt. Fred J. Gerstner	21 Dec., 1914
Godman	Stithton, Ky.	1st Lt. Louis K. Godman	28 Sept., 1918
Hazelhurst	Mineola, L. I., N. Y.	2d Lt. L. W. Hazelhurst, Jr.	11 June, 1912
Hiestand	Ft. Mayers, Fla.	Lt. Benj. Hiestand	10 June, 1918
Kelly	San Antonio, Tex.	2d Lt. G. M. E. Kelly	10 May, 1911
Langley (6)	Hampton, Va.	Prof. Samuel P. Langley	27 Feb., 1906
Love	Dallas, Tex.	1st Lt. Ross L. Love	4 Sept. 1913
Lufberry	Wantaugh, L. I., N. Y.	Maj. Raoul V. Lufberry	19 May, 1918
Luke	Pearl Harbor, H. T.	1st Lt. Frank Luke	28 Sept., 1918
March	Riverside, Cal.	2d Lt. Peyton C. March	13 Feb., 1918
Mather	Sacramento, Cal.	2d Lt. Carl Mather	30 Jan., 1918
Miller	New Dorp, Staten Is.	Capt. James E. Miller	8 March, 1918
Mitchell	Mineola, L. I., N. Y.	Maj. John P. Mitchell	6 July, 1918
McCook (7)	Dayton, Ohio	Fighting McCooks	
Park	Millington, Tenn.	1st Lt. Jos. D. Park	9 May, 1913
Payne	West Point, Miss.	Capt. Dewitt J. Payne	1 Feb., 1918
Penn	Austin, Tex.	Cadet Eugene D. Penn	21 May, 1918
Pope	Fayetteville, N. C.	1st Lt. Harlin H. Pope	7 Jan., 1919
Post	Fort Sill, Okla.	2nd Lt. Henry B. Post	9 Feb., 1914
Ream	San Diego, Cal.	Maj. Wm. R. Ream	24 Aug., 1918
Rich	Waco, Tex.	2d Lt. Percy G. Rich	13 Nov., 1913
Rockwell	San Diego, Cal.	2d Lt. Lewis G. Rockwell	28 Sept., 1912
Roosevelt	Mineola, L. I., N. Y.	Lt. Quentin Roosevelt	14 July, 1918
Ross	Arcadia, Cal.	Lt. Cleo J. Ross	26 Sept., 1918
Scott	Belleville, Ill.	Corp'l. Frank S. Scott	28 Sept., 1912
Selfridge	Mt. Clemens, Mich.	1st. Lt. Thos. E. Selfridge	17 Sept., 1908
Souther (8)	Americus, Ga.	Maj. Henry Souther	Aug., 1917
Taliaferro	Hicks, Tex.	1st Lt. W. R. Taliaferro	11 Oct., 1915
Taylor	Montgomery, Ala.	Capt. Ralph L. Taylor	2 Aug., 1917
Valentine	La Belle, Fla.	2d Lt. Herman W. Valentine	4 May, 1918
Wilbur Wright (9)	Fairfield, O.	Wilbur Wright	30 May, 1912

(1) Col. Bolling was killed by the enemy in France while in his motor car.

(2) Victor Carlstrom was a civilian instructor in the employ of the Army and was killed while flying.

(3) Octave Chanute, engineer and railroad builder, patron and authority on aeronautics; early experimenter and author of the most prominent works on aeronautics of the time.

(4) Maj. East was killed in an automobile accident.

(5) Florence Field was named for the City of Florence, Nebr.

(6) Samuel Pierpont Langely, Secreary of Smithsonian Institution, died of disease on February 27, 1906. "Langley gave to physicists firm ground to stand on," said Chanute, "concerning the fundamental question of air resistance and reaction." Best known for his experiments near Washington and for his writings on aerodynamics.

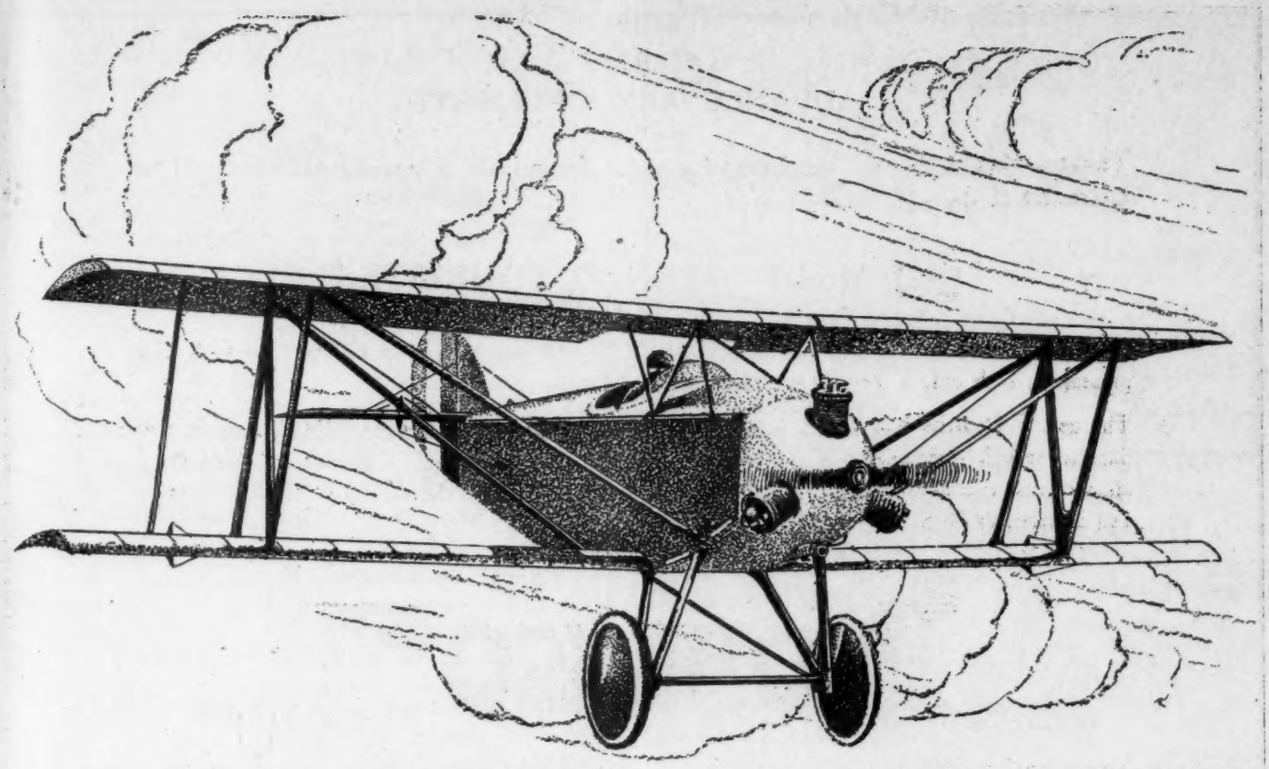
(7) McCook Field was named for a famous family of Dayton, O., known as the "Fighting McCooks."

(8) Maj. Souther was the consulting engineer of the Nat. Ass'n of Automobile Manufacturers, later becoming consulting engineer with the Air Service. He died of disease while in the Service.

(9) Wilbur Wright, with his brother Orville, produced the first practical flying machine in 193. Mr. Wright died of typhoid May 30, 1912.

(10) Named for Maj. Crissy, killed in the course of the Transcontinental Contest at Salt Lake City, Utah, en route to New York from San Francisco.

(11) Named in honor of Capt. James E. Miller killed in action March 6, 1918, while a member of the 95th Squadron in the Soissons Sector.



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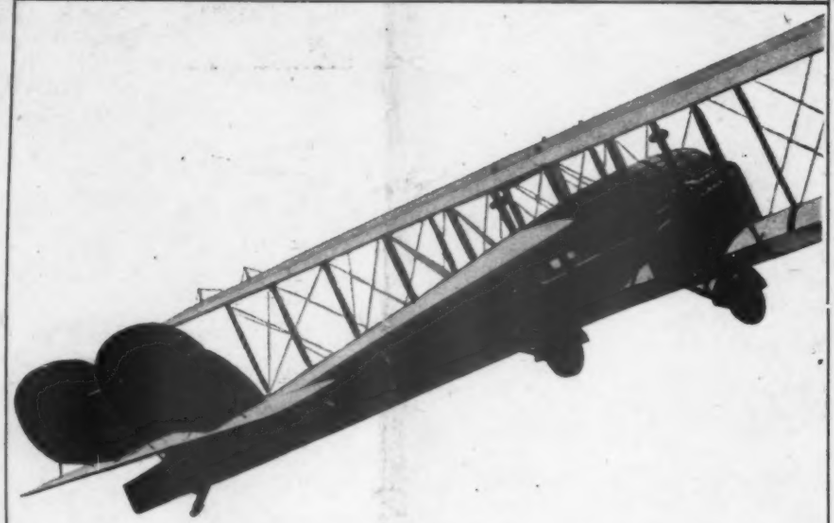

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